Message

From:	Knittel, Janette [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a955f914e8d34cb19b6f63ac60707d32-Knittel, Janette]
Sent:	8/4/2017 5:28:24 PM
To:	Davies, Lynne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=169eb6cbdebb4caf85f76390b8ab2674-LDavie12]
Subject:	FW: Updated Draft Issue Papers
Attachments:	PIT_Issue_Summary_TDU_7.31.17.docx; PIT_Issue_Summary_AABBCC_7.31.17.docx; PIT_Issue_Summary_LDRs_7.31.17.docx; PIT_Issue_Summary_PCC_7.31.17.docx

Hi Lynne. I thought you'd be interested in the draft issue papers attached below. The first three are issues we've discussed re: CWMNW, particularly the first two. Lisa Olson is attending the RCRA BC meeting next week where these will be discussed.
-Janette

From: Olson, Lisa
Sent: Wednesday, August 02, 2017 8:29 AM
To: Bartus, Dave <Bartus.Dave@epa.gov>; Blankenship, Melissa <Blankenship.Melissa@epa.gov>; Castrilli, Laura <Castrilli.Laura@epa.gov>; Hedeen, Roberta <Hedeen.Roberta@epa.gov>; Knittel, Janette <Knittel.Janette@epa.gov>; Macduff, Sean <macduff.sean@epa.gov>; Palumbo, Janice <Palumbo.Jan@epa.gov>; Valdez, Heather <Valdez.Heather@epa.gov>
Subject: FW: Updated Draft Issue Papers

Good morning,

FYI - Attached below are the four draft issues papers that we provided comments on. These will be shared with the Branch Chiefs next week and later on with the Division Directors, who will decide which issues to work on at the national level.

Thanks –

Lisa

Lisa Olson
US EPA Region 10, Office of Air and Waste
1200 Sixth Avenue, M/S: AWT-150
Seattle, WA 98101
Desk: 206-553-0176
Cell: 206-321-2767

****
Subject: Updated Draft Issue Papers

Hello Permit Integrity Team,

Here are the updated drafts of the 4 issue papers that we are going to share at the Branch Chiefs Meeting next week. Thank you to all of you who contributed! Please keep in mind that these are going to be considered as working drafts all the way until we present them to the RCRA DD's for decision/prioritization; so feel free to continue gathering feedback from your states.

PIT_Issue_Sum... PIT_Issue_Sum... PIT_Issue_Sum... PIT_Issue_Sum...

Thank you,

Lilybeth

Lilybeth Colón | Environmental Engineer
U.S. EPA | OLEM | Office of Resource Conservation and Recovery
T: 703-308-2392 | O: Potomac Yard South: Mail Code: 5303P

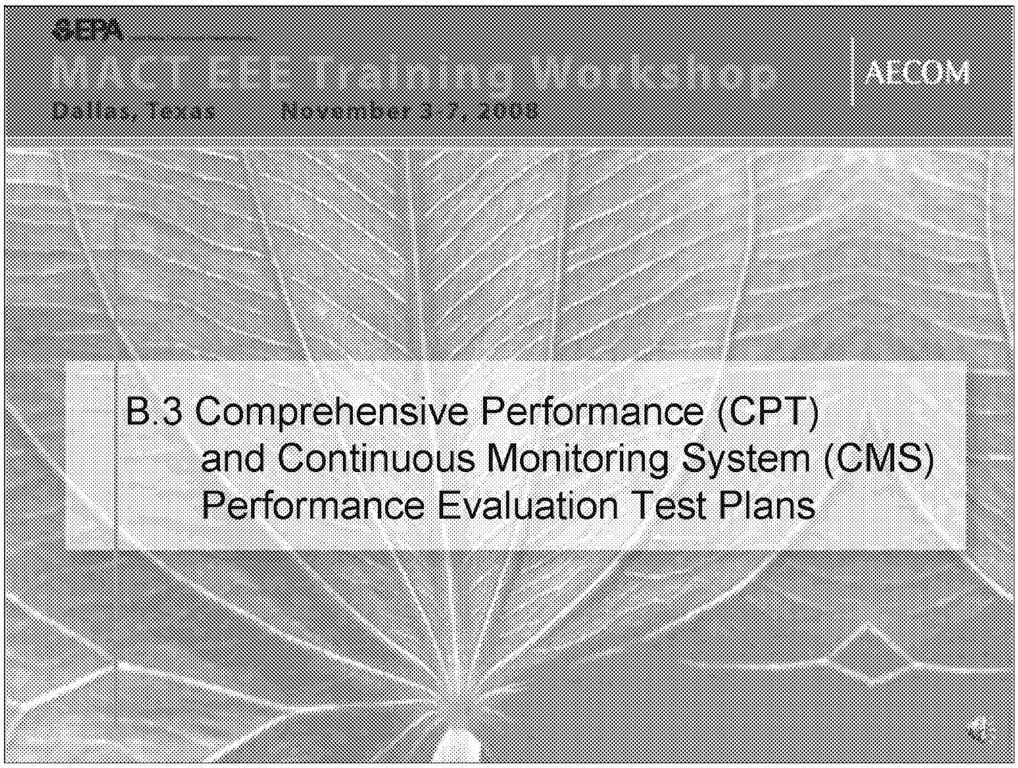
Message

From: Knittel, Janette [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a955f914e8d34cb19b6f63ac60707d32-Knittel, Janette]
Sent: 6/6/2017 11:29:10 PM
To: Dossett, Donald [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c4183298cd1742b5a39829e31c720571-Dossett, Don]
CC: McArthur, Lisa [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=524660efbdb140e7868646d8073f0c72-McArthur, Lisa]; Valdez, Heather [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=eb323347294d44009a369c3576798bdf-Valdez, Heather]; Davies, Lynne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=169eb6cbdebb4caf85f76390b8ab2674-LDavie12]
Subject: memo re: Chem Waste ORU RCRA/Air issue
Attachments: 17 06 06 Chem Waste Don Dossett Memo v2.docx; SA 22 Draft Clean.docx; 11-0002-SI-01-PmtMod1-28517-FNL.docx; 11-0002-SI-01-RRmod1-28517-FNL.docx; RO 13657.pdf; RO 14266.pdf; 4-27-90 Preamble Proposed Rule 55FR17869 - Definitions of infrared incinerators.pdf

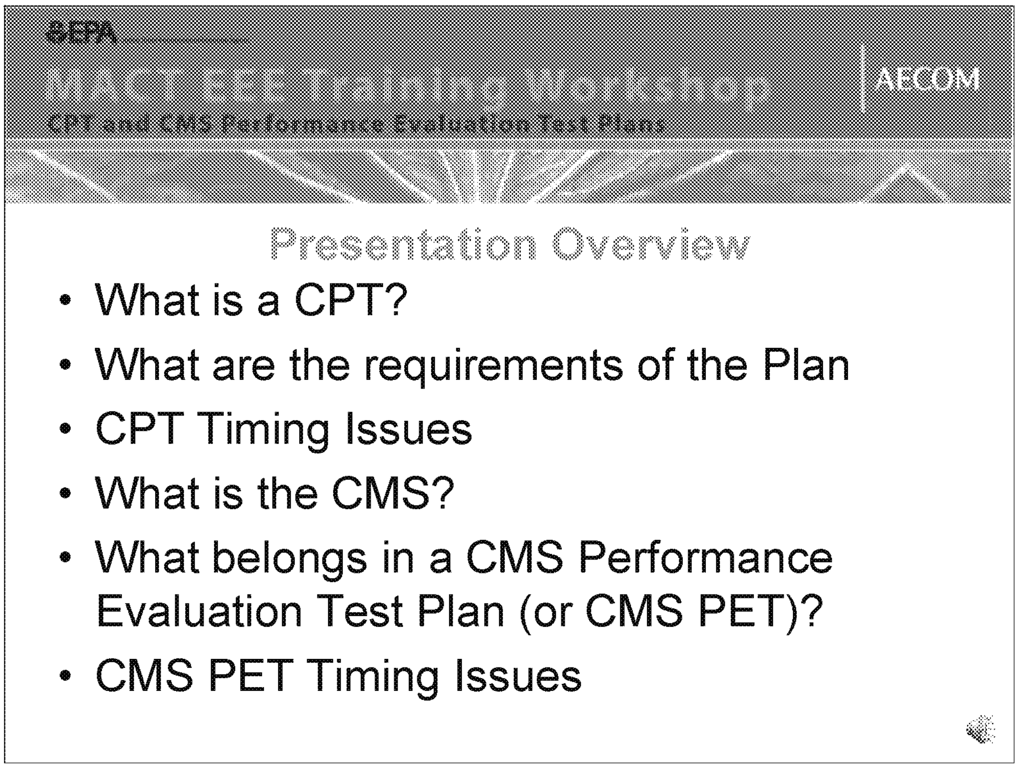
Hi Don,
Lisa told you I would be sending you a brief paper that summarizes the gist of the issue we're facing regarding the Organic Recovery Unit at the Chem Waste facility in Oregon. Attached please find the memo along with the attachments which are listed at the bottom of the memo. After you have a chance to digest this, Lisa, Heather, and I would like to meet with you. I'll be on leave until Tuesday, June 13. I'll set up a meeting when I return.

Thanks for your time,
Janette

Janette Knittel
U.S. EPA Region 10
Office of Air and Waste
RCRA Corrective Action, Permits, and PCB Unit
1200 6th Ave, Suite 900, OAW-150
Seattle, WA 98101-3140
206-553-0483
knittel.janette@epa.gov



This module summarizes requirements pertaining to Comprehensive Performance Test (CPT) and Continuous Monitoring System Performance Evaluation Test (CMSPETs) Plans



Each of these will be defined and a discussion of what the requirements are for each type of plan. Finally, scheduling and timing of each of these plans will be presented.

EPA

MACT EEE Training Workshop

CPT and CMS Performance Evaluation Test Plans

AECOM

Overview of the CPT

- NESHAP regulations all have some type of performance test requirements
- Subpart EEE requirements are patterned after the similar RCRA Trial Burn Requirements
  - Not like BIF Certification of Compliance
- Purpose is to test unit performance under worst case feed/operating conditions to
  - Show compliance with emissions standards
  - Establish operating limits that will allow ongoing compliance

NESHAP regulations in general each have some type of performance test requirements associated with them. For Subpart EEE units, the CPT requirements are patterned after historical Trial Burn testing requirements contained in RCRA, but are much more rigorous in general than the BIF Certification of Compliance. The primary object of CPTs performed under Subpart EEE is to test units under worst case operating conditions to show compliance with the emissions standards while establishing operating limits that will assure ongoing compliance.

What is a CPT Plan?

- It is a stack testing protocol that includes
  - Details of the unit(s) to be tested
  - Details on the waste(s) treated
  - Operating the unit(s) under one or more "worst case" conditions
  - Feeding waste and/or surrogate fuels
  - Relevant QA/QC processes and activities to validate the data

In general, a Subpart EEE CPT Plan is a stack testing protocol that includes the several components listed in the slides. These requirements are detailed in the regulations at 40 CFR 63.1207. Besides providing technical details of the unit(s) to be tested and wastes that are routinely processed, the CPT Plan describes how the unit will be operated during the test so that the dual objective of showing compliance with standards and establishing Operating Parameter Limits (or "OPLs") that establish the minimums or maximums under which a unit can be operated (termed the "operating envelope") will be achieved. The test may be comprised of a single test condition with three replicate test runs or it may be designed for two or more test conditions of three replicate runs each as not all OPLs can be achieved in a single test condition. The description of the test condition will also include what wastes or other materials (i.e., "surrogates") will be fed in what quantities and feed rates. And finally, the CPT Plan must contain relevant and applicable QA/QC requirements needed to assure that all data collected is accurate and meets accepted quality criteria for the purpose for which it is being used.

MACT EEE Training Workshop

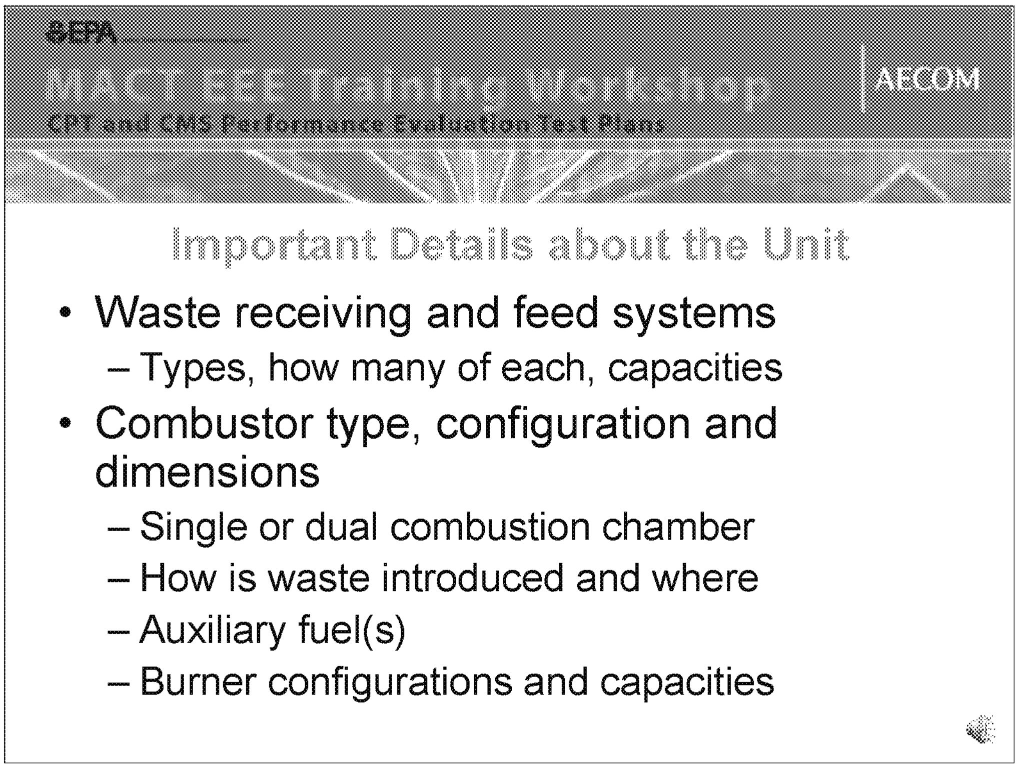
CPT and CMS Performance Evaluation Test Plans

AECOM

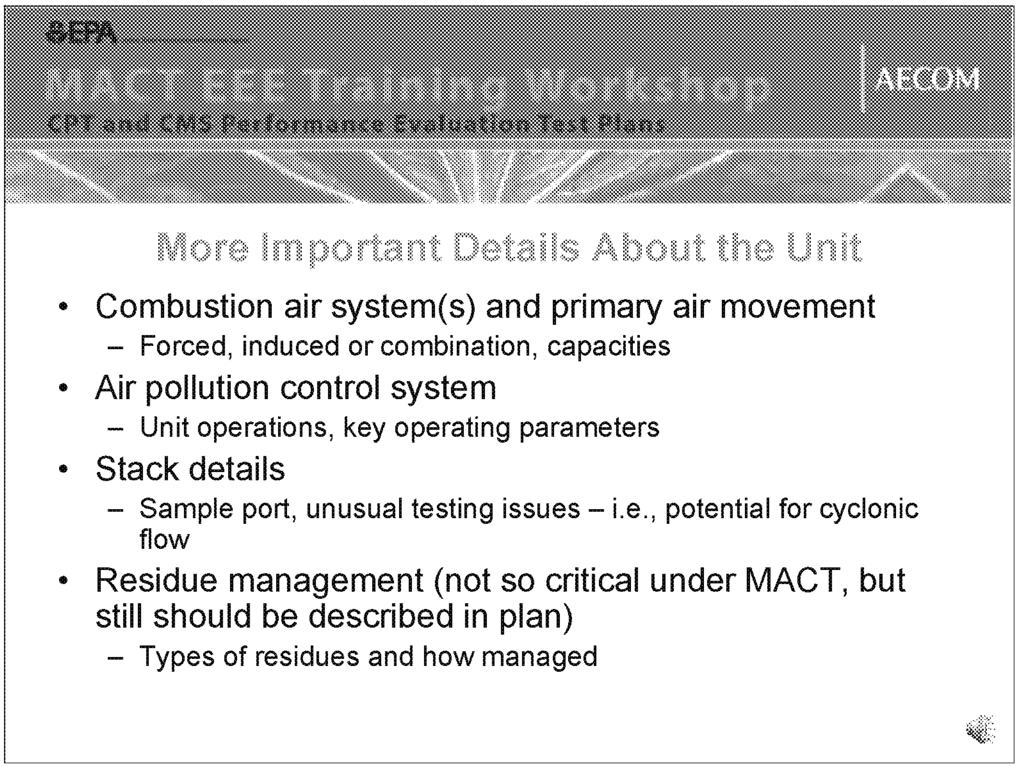
Required Content of the CPT Plan

Topic	Regulatory Citation
Program Summary	40 CFR § 63.1207(f) and § 63.7(c)(2)(i)
Test schedule	40 CFR § 63.1207(f), (f)(1)(v) and § 63.7(c)(2)(i)
Data Quality Objectives (DQOs)	40 CFR § 63.1207(f) and § 63.7(c)(2)(i)
Internal and External Quality Assurance Plan	40 CFR § 63.1207(f) and § 63.7(c)(2)(i)
Analysis of feedstreams (as fired)	40 CFR § 63.1207(f)(1)(i)
Detailed engineering description of combustor	40 CFR § 63.1207(f)(1)(iii)
Description of Waste handling and blending Operations	40 CFR § 63.1207(f)(1)(ii)(C)
Detailed test protocol Planned Feed and Operating conditions during the CPT	40 CFR § 63.1207(f)(1)(iv) 40 CFR § 63.1207(f)(1)(vi) & (vii)
Procedures for rapidly stopping hazardous waste feed and controlling emissions during malfunction	40 CFR § 63.1207(f)(1)(viii)
Determination of hazardous waste residence time	40 CFR § 63.1207(f)(1)(ix)
Metal feed rate limit extrapolation (if used)	40 CFR § 63.1207(f)(1)(x)
CMS and CEMS performance evaluation plans	40 CFR § 63.8(e)(4) and 1207(b)(1)
Levels of regulated constituents feedstreams that are not analyzed	40 CFR § 63.1207(f)(1)(xi)
Conditioning time needed to reach steady state prior to testing	40 CFR § 63.1207(f)(1)(xii)

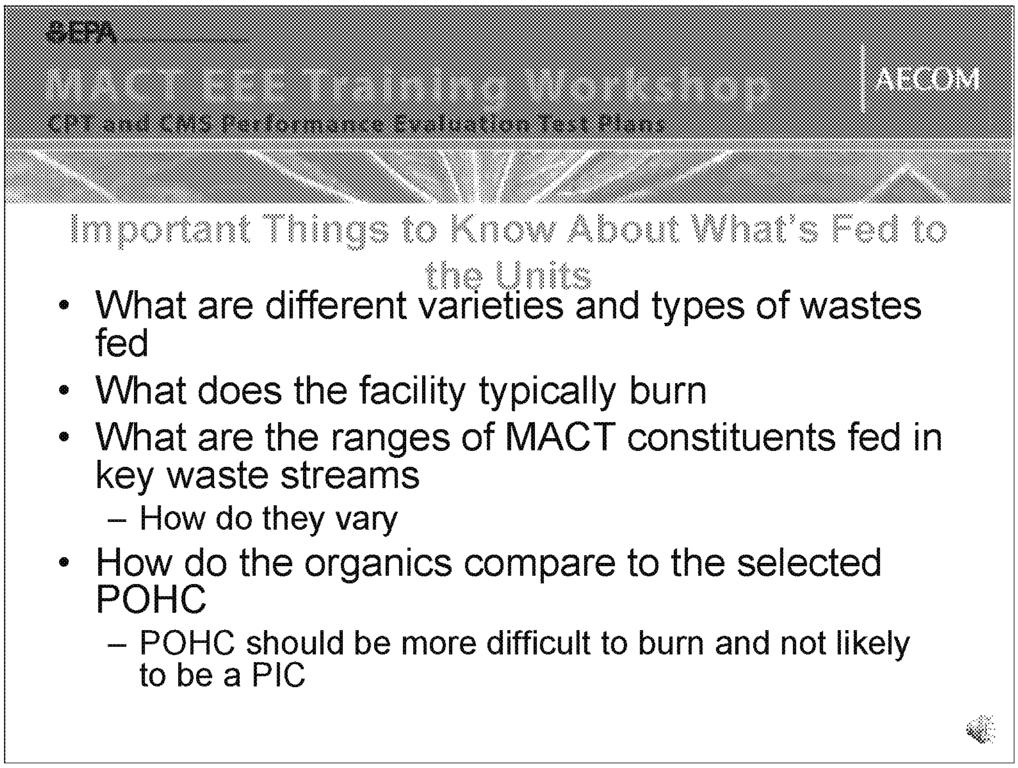
A detailed summary of the content of a CPT Plan and its associated regulatory citations are shown in this table.



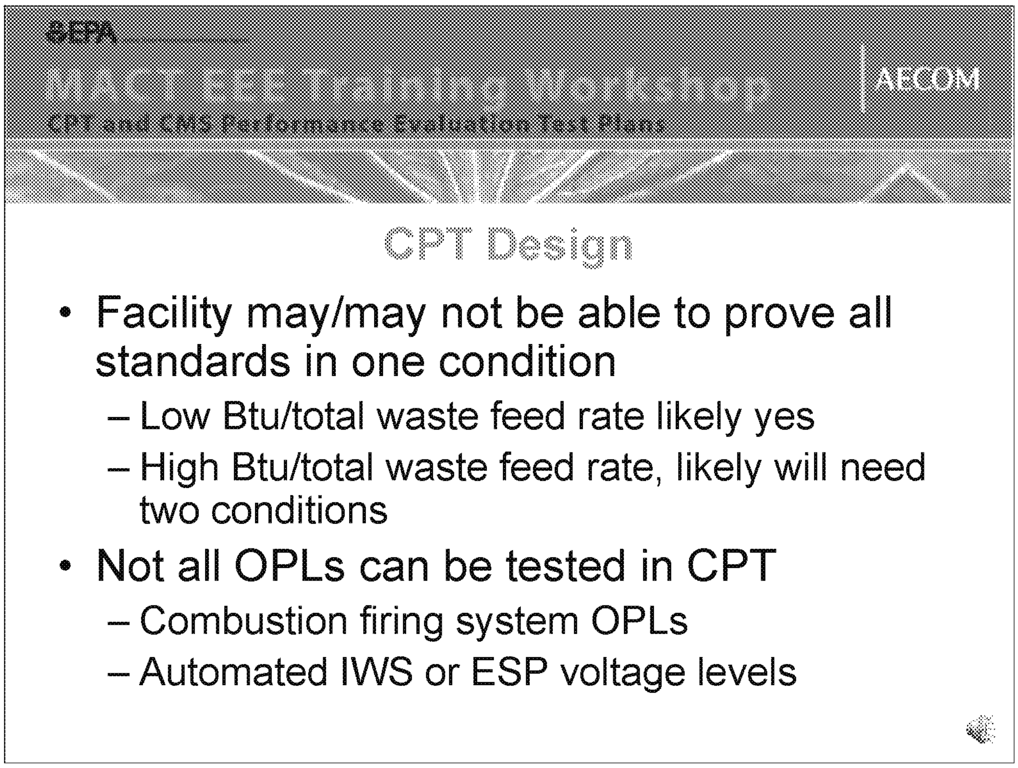
In order to adequately understand how the CPT Plan will actually demonstrate compliance with Subpart EEE, it is first important to understand the unit(s) being tested from a technical standpoint. Starting with waste handling systems, the overall feed systems should be understood along with what is proposed to be used for the CPT. In addition, details regarding the combustion portion of the unit should be reviewed as well.



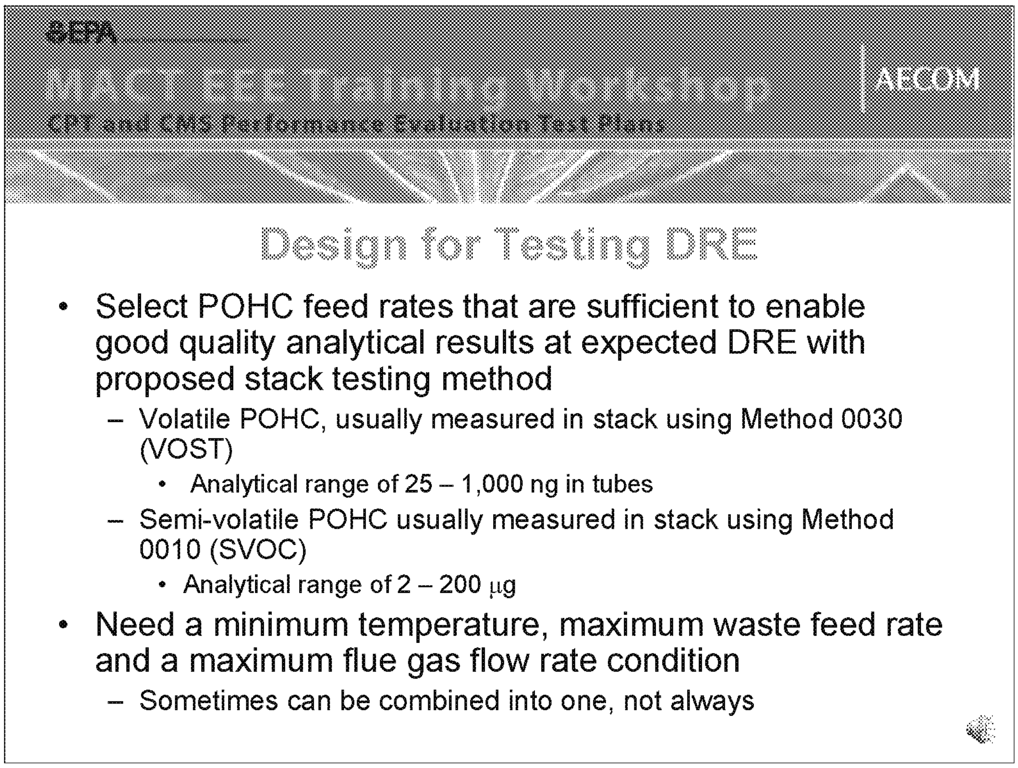
As part of understanding the combustion system, combustion air supply should be understood along with knowing whether the unit is maintained under vacuum (via use of induced draft fans), under positive pressure (using forced draft fans) or is a combination of the two, resulting in a balanced draft operation. Unit operations that are part of the air pollution control system should be reviewed along with their relevant OPLs. From an actual testing perspective, it is important to understand the specifics of how the stack testing is going to be completed and whether there might be any unusual testing issues (such as the presence of cyclonic flow) that may arise due primarily to sample port location and the type of stack flow expected at the sampling location(s). Finally, while residue management is not a direct factor in MACT CPTs, an understanding of combustor residues and how they are managed should be obtained.



Some facilities, particularly commercial units and onsite facilities servicing large manufacturing plants can manage a broad range of waste materials over the course of a year. However, in most cases, these HWC's will typically burn a predominant subset of the total number they might handle. To understand how best to evaluate the CPT design, these top streams should be reviewed to understand what predominant physical forms of waste are fed and what the range of HAPs and MACT constituents are in those streams. HWCs can provide historical feed rate information along with profiles of their top waste streams in the CPT Plan. This information is useful in assessing whether the proposed CPT feed rates for inorganic constituents regulated under Subpart EEE make sense considering historical feed rates and also whether the compound being chosen for the DRE test (The Principal Organic Hazardous Constituent or POHC) represents a more difficult to burn organic compound than is typically managed. Guidance criteria for POHC selection is the same as what has been used historically under RCRA and POHC should also be selected that are not likely to be present in emissions as a Product of Incomplete Combustion or PIC as this could adversely affect the emission rate and put the DRE results into question.

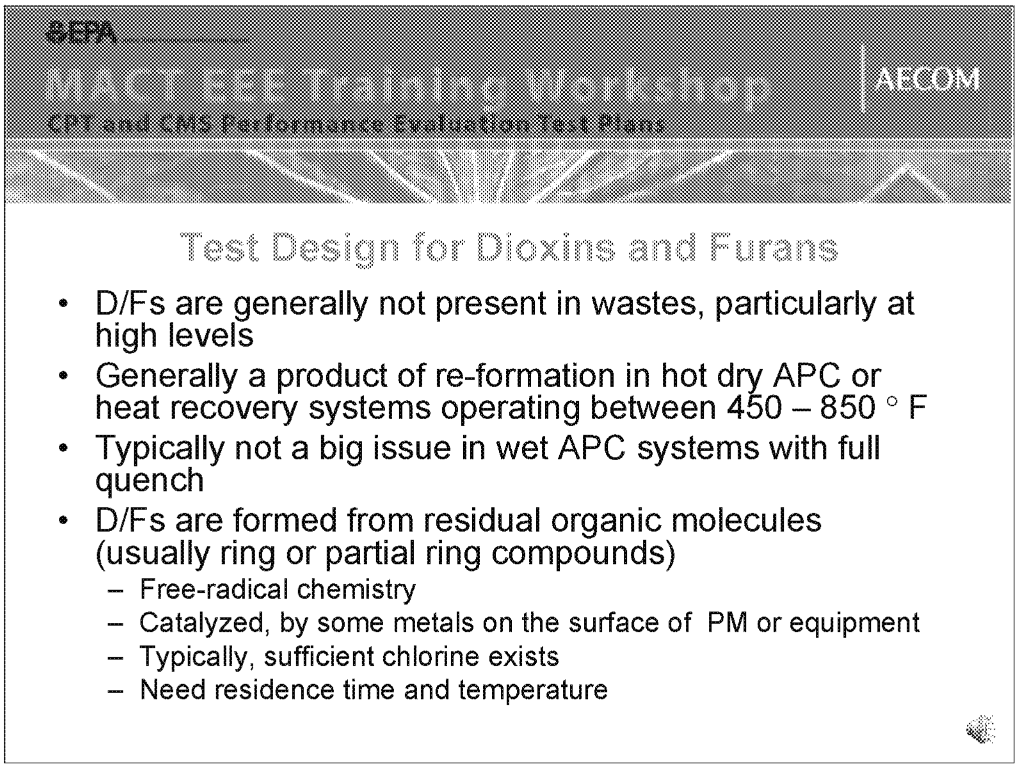


HWCs are not required to conduct CPTs under a single test condition. In fact, there are situations where this is not possible. The most common example of where two test conditions may be needed is for units that treat wastes with a relatively high Btu content. In this case, it will be physically impossible to establish a minimum temperature limit that is required for DRE while at the same time setting a maximum throughput limit that is required for other standards in the same condition. In addition, not all OPLs can be tested during a CPT and some must be set based on operating experience or manufacturer's recommendations. For example, most atomizing media systems (steam or air are the most common, but natural gas can be used for atomization as well) are designed to provide a certain minimum atomizing pressure and either it is on and working or it is not. The HWC cannot "dial in" a certain minimum pressure or flow rate for atomization as the system is generally not designed to be controlled. Similarly, ionizing wet scrubbers (IWS') and electrostatic precipitators (ESPs) are designed with control electronics that adjust the voltage to the electrified field based on how much particulate matter is being handled. Thus, these units are not designed to manually control voltage and cannot "set" a minimum voltage during a CPT.



As mentioned in a previous slide, POHC selection is still done the same way it was for RCRA Trial Burns and has some general guidelines associated with it. First, a POHC or POHCs should be selected on the basis of whether or not they are more difficult to burn than the predominant organic wastes being treated in the HWC. There are two generally accepted criteria for this. The first method is based on the principal of thermal stability which was developed at the University of Dayton Research Institute (UDRI). This approach is based on gas-phase thermal stability under oxygen-starved conditions. Compounds are ranked on the basis of the temperature required for 99 percent destruction at a residence time of two seconds. The second is based on considering the higher heat of combustion of the waste and intended POHC as it is generally held that burning a waste with a lower heat of combustion is more difficult than burning one with a higher heat of combustion. The two approaches are often used together but it is important to also look at what has historically been used at the HWC as well.

Additionally, POHC feed rates should be selected such that sufficient amounts are fed so that the expected DRE can be calculated from an actual emission rate in the stack (versus a non-detect result). While ND stack values can certainly be used to calculate a DRE, if too low a rate of POHC has been fed, the necessary DRE may not be shown. Feed rates for volatile and semi-volatile POHCs or thus chosen based on expected DRE and the dynamic range of the analytical method being used.



In designing CPTs to test for dioxins and furans, it is important to understand a few things about them. First, in most cases, these compounds are not present in wastes and only in very unique situations would they be present at high levels, unless the manufacturing chemistry would indicate otherwise. For almost all HWCs then, Ds and Fs are generally a result of re-formation in post combustion air pollution control equipment, in particular, where such equipment is operated within the temperature range of 450 to 850 F. Examples include hot baghouses or ESPs and units with heat recovery. D/F reformation is generally not an issue where rapid quench, water based air pollution control equipment is used. In order for these compounds to re-form though, not only does the temperature need to be in the range discussed, but the presence of ring or partial ring compounds as PICs is important as well. In addition, studies have shown that some metals, like copper can catalyze the reaction where there is adequate particulate matter or other surface area for the reaction to proceed and where adequate residence time exists within the correct temperature range.

MACT EEE Training Workshop

CPT and CMS Performance Evaluation Test Plans

AECOM

Test Design for Dioxins and Furans – Things that MACT Requires

- Maximum temperature limits at
  - Inlet to dry APC
  - Outlet from combustion chambers for cement kilns
- Need a minimum temperature, maximum waste feed rate and a maximum flue gas flow rate condition
- Additional limits for use of
  - Carbon injection systems
  - Catalytic oxidizers
  - Dioxin inhibitor systems

From a CPT design perspective, Subpart EEE requires some specific maximum temperature limits as described above and in addition, for a number of subcategories it requires establishing the same limits for DRE. Solid and liquid fuel boilers, hydrochloric acid production furnaces and light weight aggregate that are not subject to a numerical emissions standard must conduct a one time test that is reflective of daily maximum operating variability. For units equipped with carbon injection systems, catalytic oxidizers or D/F inhibition systems, additional OPLs as defined in 40 CFR 63.1209 and discussed in a later module will apply and must be incorporated into the CPT Plan.

EPA

MACT EEE Training Workshop

CPT and CMS Performance Evaluation Test Plans

AECOM

Test Design for HCl/Cl_2, PM and Metals

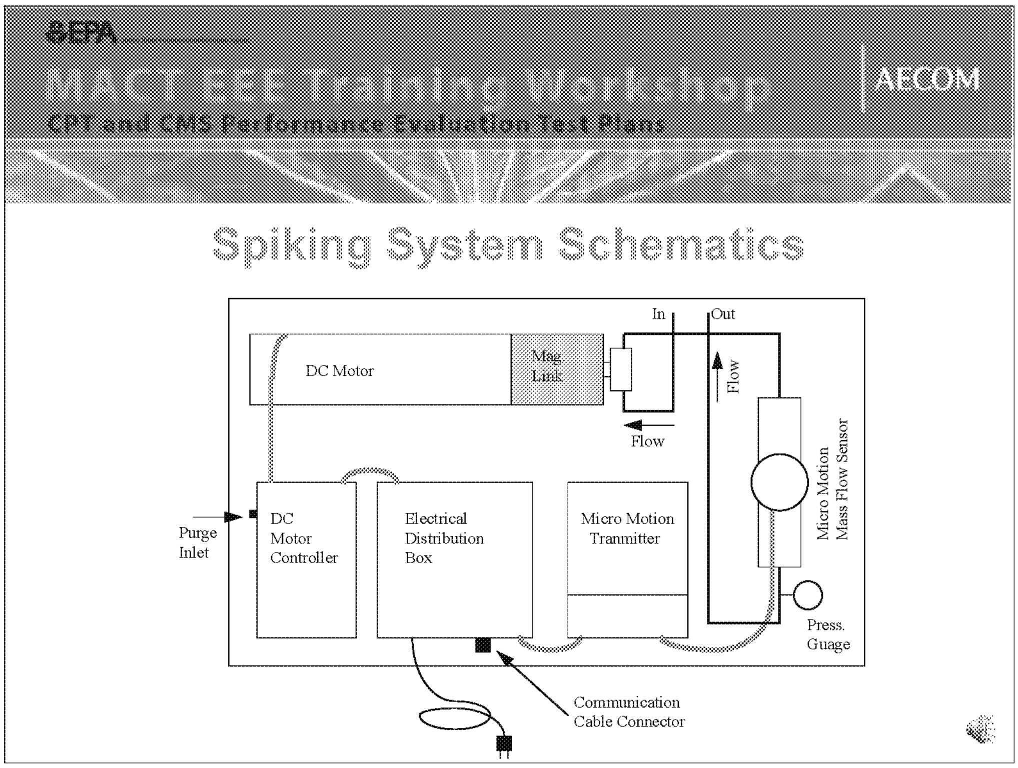
- First evaluate feed ranges and assess
  - Whether planned feeds can deliver adequate rates to set good feed limits, or
  - Whether actual ranges are sufficiently far below limits that MTEC can be used
- If levels may not be at maximum during CPT and/or facility needs to account for removal in unit, spiking is likely needed

For the inorganic Subpart EEE constituents and particulate matter, it is important to review historical feed ranges to assess whether the planned feed rates can deliver adequate feed limits or whether the actual ranges are sufficiently below the standard such that it makes sense to use an MTEC approach for compliance purposes. Where MTEC cannot be used and where normal feed rates may not provide sufficient amounts of metals, ash or chlorine/chlorides and yet maximum feed rates indicate the need to set higher OPLs for these constituents, spiking must be considered.

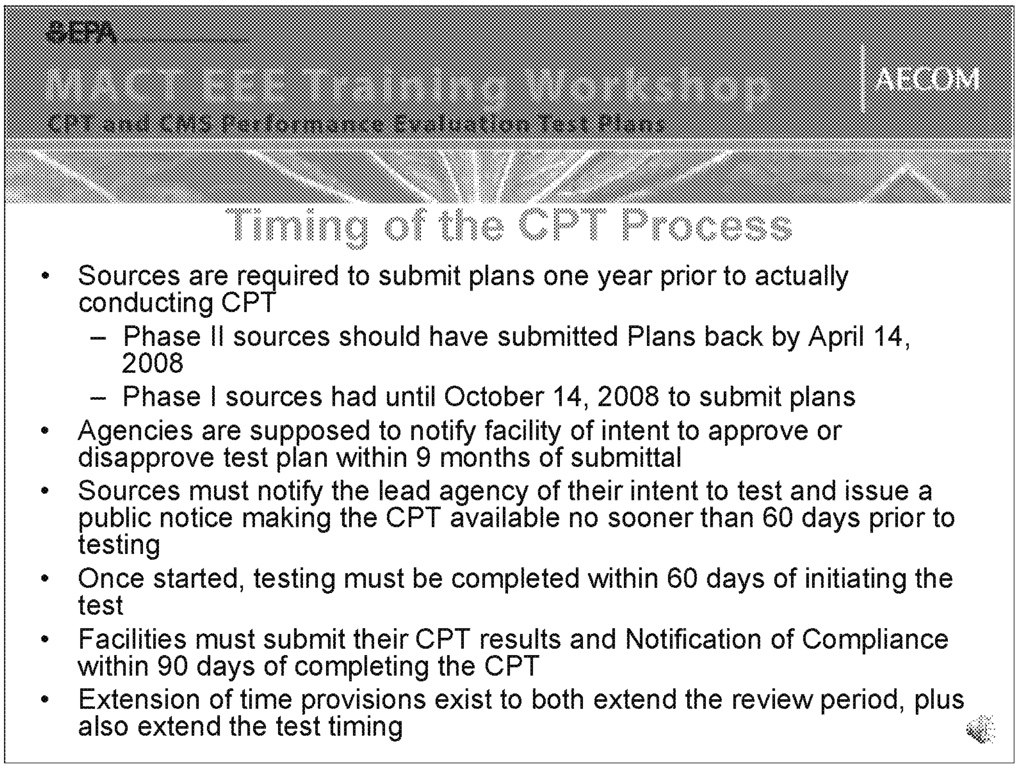
Selection of Inorganic Spiking Approaches

- Safety first, pick materials that can be safely handled
- Pick materials that can be provided by commercial suppliers with a certificate of analysis
- Deliver spiked materials to emulate how combustor would actually see them
  - As solid with solid feed
  - As liquid in liquid feed – organic/aqueous
  - Combination
- Need to consider impact of spiked materials on
  - Combustor materials
  - Downstream systems like wastewater treatment plants
- Always sample waste upstream of spiking location
  - Can choose to ignore or count feed contributions in removal efficiency calculations

There are many options to choose from in terms of using materials besides routine waste in order to “spike” selected constituents at the desired rates during a CPT. First and foremost is the issue of safety and obtain Material Safety Data Sheets (MSDS’) from candidate suppliers as part of the initial planning. Materials that are highly hazardous or toxic should be avoided if possible and any spiked materials must be compatible with the waste streams and construction materials of the feed systems or they should be avoided for those reasons as well. Spike materials can be provided by commercial suppliers with a certificate of analysis (COA) indicating the concentration or purity of the constituent you are interested in and should be provided in a physical form that is representative of how the target constituents might normally be fed. In addition to satisfying the test objectives and compatibility with initial feeds and feed systems, impacts on the rest of the HWC and any downstream treatment systems like a wastewater treatment plant should be considered as well. Obviously if the spike materials are to be fed in very small amounts, these impacts may be insignificant, but in some cases, excessive equipment corrosion, refractory impacts or possibly operational or compliance impacts on a downstream wastewater treatment system could be problematic. Generally, it is good practice to waste streams upstream of spiking location so that native wastes can be evaluated by themselves. Contributions from the spiked materials should be based on accurate tracking of feed rates and the COA. It is also important to note for removal efficiency determinations, it is common to ignore contributions from waste streams and rely solely on the amount spiked for the input amount as this represents a conservative assessment of the unit’s performance.

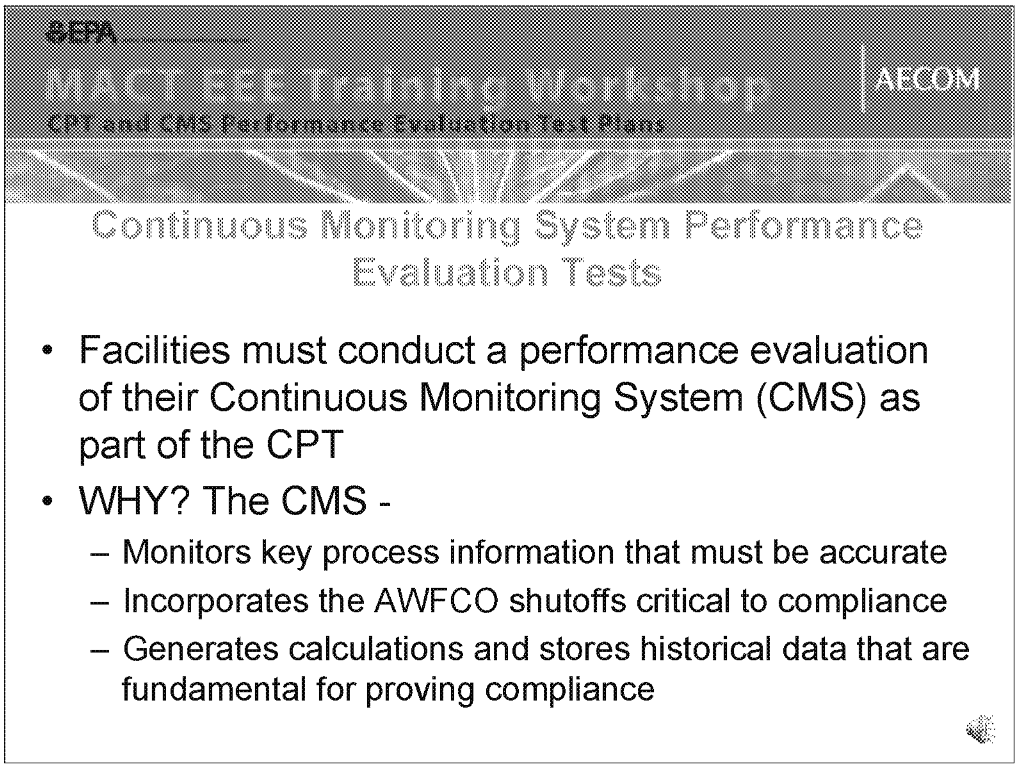


This slide shows a typical spiking system used to spike liquid solutions. Of importance in this are a couple of items. First, the pump should be a positive displacement "metering" type pump, these are designed to deliver precise amounts of material. Second, reliable, calibrated flow metering technology is also essential. These are generally connected to a data logging system or laptop capable of monitoring the entire operation. It is common that separate systems are used for each spiked material and that they are fed discretely from separate solution containers to avoid mixing and assure accurate feed rates are delivered according to the CPT Plan.

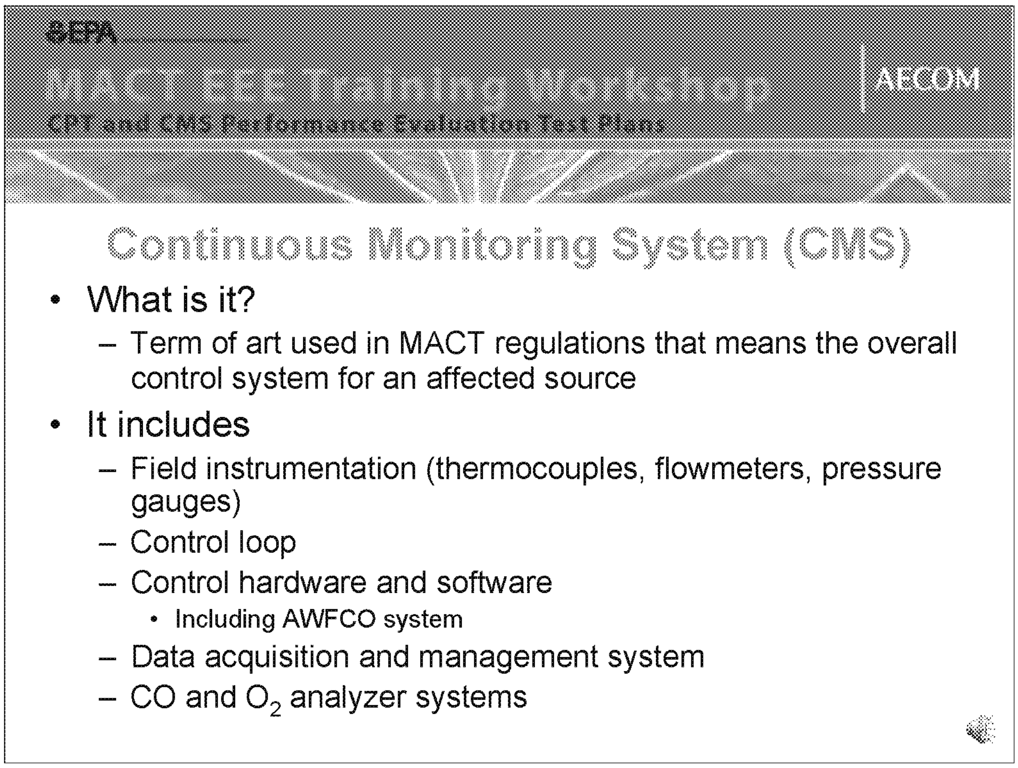


From a timing perspective, HWCs are required to submit CPT Plans at least one year prior to when they plan to be conducted. For Phase II sources not granted an extension of time, this should have been done by April 14, 2008. Phase I sources had until October 14, 2008 to submit their plans. Agencies are supposed to notify facilities of their intent to approve or disapprove the plan within 9 months of submittal. Sources must then notify the agency of their intent to test and issue a public notice making their plan available 60 days prior to testing.

Once the CPT begins, it must be completed within 60 days, unless other arrangement can be agreed to with the lead agency and results and the associated Notification of Compliance or NOC must be submitted within 90 days of completing the CPT. Extension of time provisions do exist for both the test plan review period and also for extending the duration of the CPT.



Switching now to the Continuous Monitoring System Performance Evaluation Test or CMS PET, HWC's must conduct this as part of conducting their CPT. This is an essential component of conducting CPT as it involves assuring that all the critical process information, waste feed cutoffs and process data needed to establish OPLs is accurate and working properly.



Basically, the CMS is a term used in NESHAP regulations to describe the process monitoring and control system used at the HWC. The CMS includes field instrumentation used to monitor process operations and performance, the control loop meaning the signals from the field instrumentation, the process control system through which they are processed and the control hardware that uses output signals from the process control hardware and software to adjust the process, the central processing unit that performs the various process calculations sent to the control equipment, the data acquisition and management system, which is typically a separate computer used for data archiving and long term storage and finally the Continuous Emission Monitoring (or CEMs) systems for oxygen and carbon dioxide.

MACT EEE Training Workshop

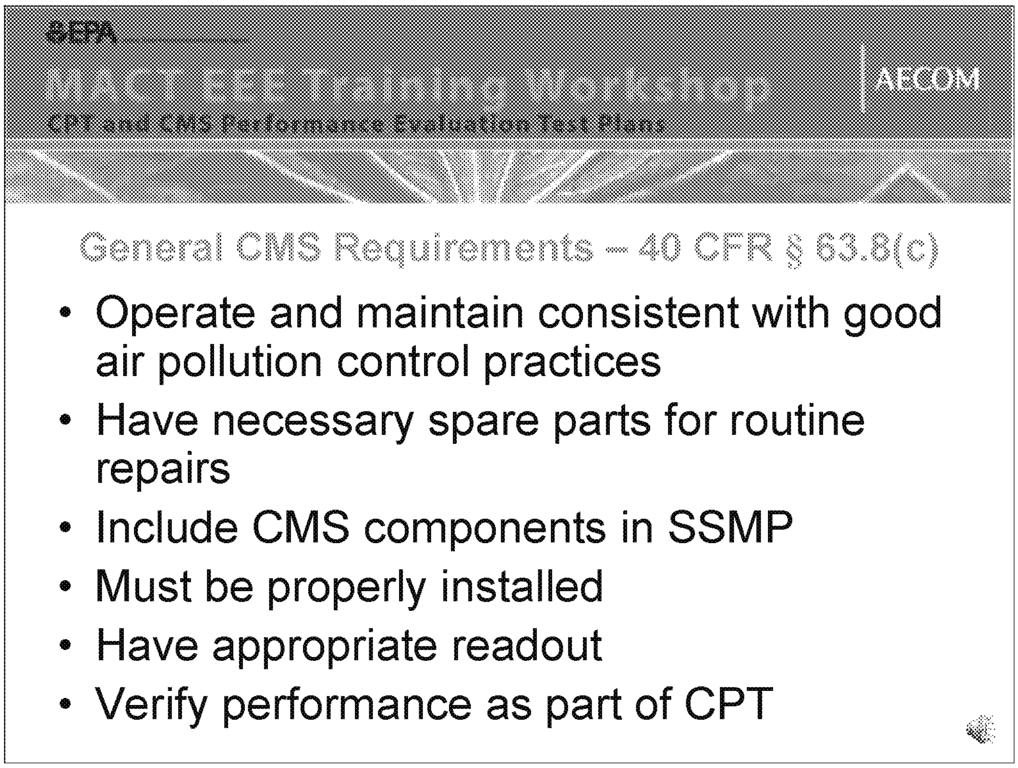
CPT and CMS Performance Evaluation Test Plans

AECOM

CMS Components - Control Loop

- Field Transmitters and wiring back to control system
- Some type of process control system that
  - "Samples" process data very rapidly
  - Performs calculations to analyze status of system (hourly and 12 hour averages)
    - Compare actual feed rates to limits
  - Sends output signals to control devices
    - Adjust controls (0-10 volt or 4-20 mili Amp)
    - Open or close valves (energize or de-energize a circuit)

In more detail, the control includes field located transmitters that send output signals from the process instruments back to the control system. These electrical signals are usually digital either indicating equipment is "on" or "off" or analog, providing a variable strength signal that the process control computer can interpret as some value within 0 to 100% of the range of that instrument. The process control computer then performs calculations to analyze the status of the HWC and sends output signals back to control equipment, like valves, or pumps to adjust their operation. Digital, on/off signals open or close valves and analog signals make adjustments to current settings by changing their signal which is either typically a 0 to 10 volt signal or a 4 to 20 milli amp signal.

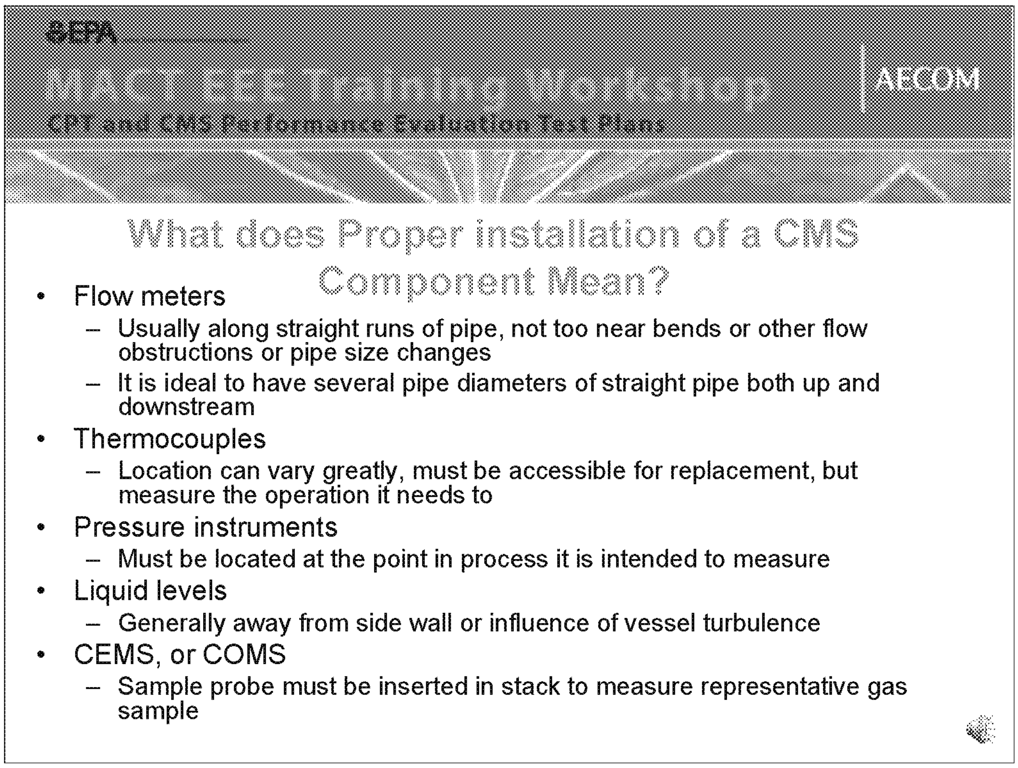


There are general requirements for the CMS that can be found in the regulations at 40 CFR 63.8(c) that include the items summarized on the slide above. Interpretation of these requirements for specific HWC's will depend on the unit and what kind of equipment is included in the CMS.

General CMS Requirements – 40 CFR § 63.8(c) - continued

- CMS components must be in continuous operation
  - Except for calibrations or malfunctions
- COMS – sample process every 10 seconds, record data for successive 6 minute periods
- CEMS – one cycle of operation at least every 15 minutes
- Facility must correct out of control CMS
  - Under HWC MACT, initial step is an AWFCO

One key aspect of the CMS is that it must be in continuous operation while the HWC is burning hazards waste in order for the unit to be in compliance. The General Provision also do stipulate operational requirements for opacity carbon dioxide and oxygen continuous monitors and HWC's must correct any CMS that operate out of control. Under Subpart EEE, if this occurs, the HWC must initiate an Automatic Waste Feed Cutoff and correct the issue before re-commencing the treatment of waste.

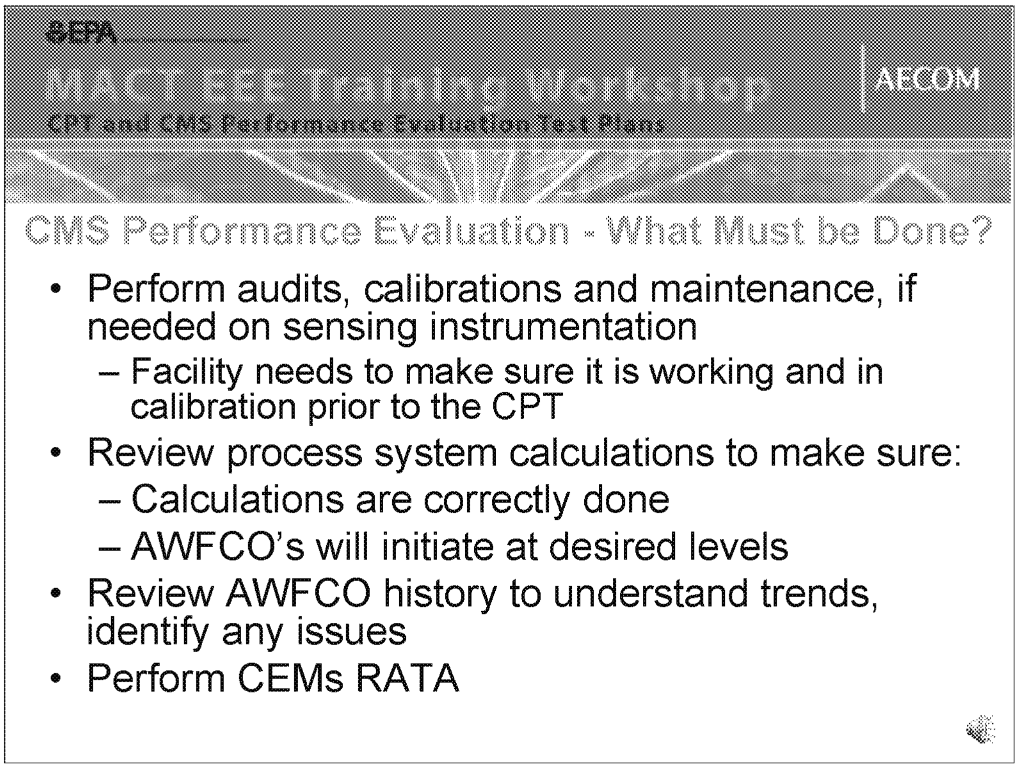


Manufacturers of process instrumentation have installation specifications to assure their equipment is installed correctly. Incorrect installation can lead to faulty reading that are not indicative of representative process conditions. In general terms though, flow meters usually should be located along straight runs of piping so that there are several pipe diameters both upstream and downstream of any bends or other obstructions (like valves) that could affect the accuracy of the flow reading. Thermocouple location can vary greatly and sometimes facilities install multiple ones to monitor the part of the process, but these should be located so that they measure the temperature they are intending to and also so that they can be readily replaced as facilities often replace these on a fairly regular basis. Pressure instrumentation should be located with similar guidelines as thermocouples. Liquid level measurement, such as for tank levels should be located generally away from vessel side walls and CEMS or COMs sample points must be located in stacks so that they cam measure a representative sample of the gas stream.

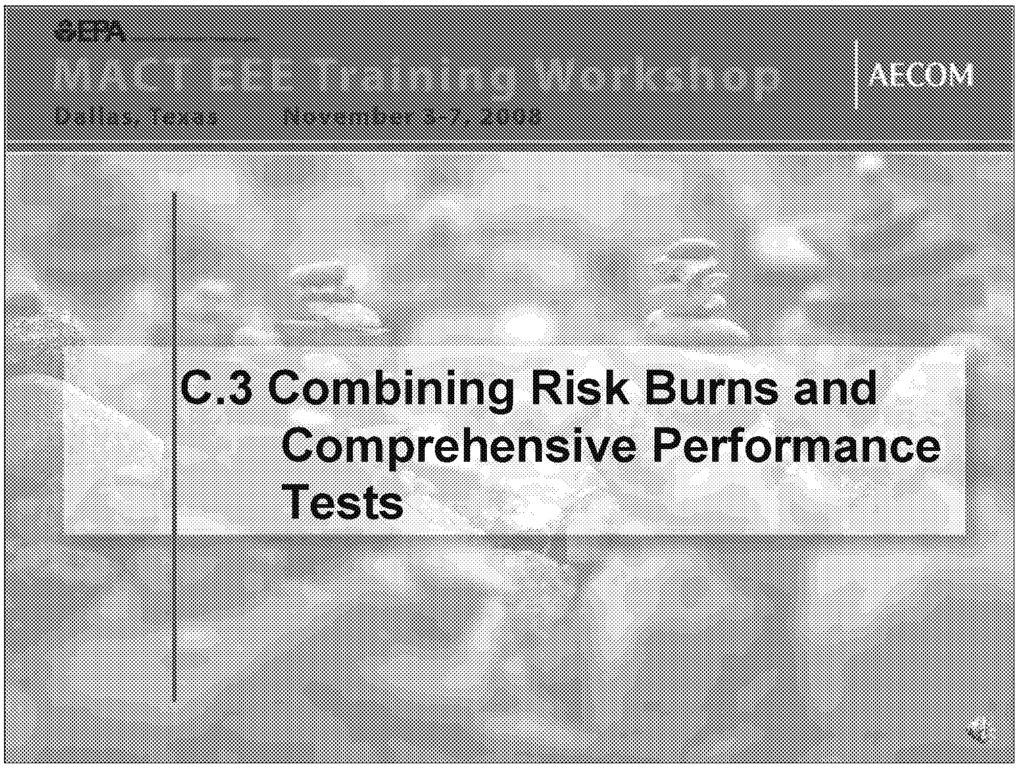
CMS Program – Example Calibration Frequencies

Parameter	Units	Equipment Type	Calibration or Replacement Frequency
Maximum Hazardous Waste Feed Rate	lb/hr	Mass flow meter	Annually
Maximum Total Pumpable Hazardous Waste Feed Rate	lb/hr	Mass flow meter	Annually
Minimum Steam Production Rate	lb/hr	Calculation	N.A.
Maximum Steam Production Rate	lb/hr	Calculation	Annually
Minimum Combustion Chamber Temperature	° F	Thermocouple	Annually
Maximum Combustion Chamber Temperature	° F	Thermocouple	Annually
Maximum Combustion Air Flow	MM SCFH	Annubar	Annually
Maximum Ash Feed Rate	lb/hr	Calculation	N.A.
Maximum mercury feedrate	lb/hr	Calculation	N.A.
Maximum SVM (Cd + Pb) Feed Rate	lb/hr	Calculation	N.A.
Maximum LVM (Cr only) Feed Rate	lb/hr	Calculation	N.A.
Maximum Chlorine Feed Rate	lb/hr	Calculation	N.A.
Maximum stack gas carbon monoxide concentration	ppmv, dry @ 7% O_2	Infrared analyzer	Daily, quarterly, annual

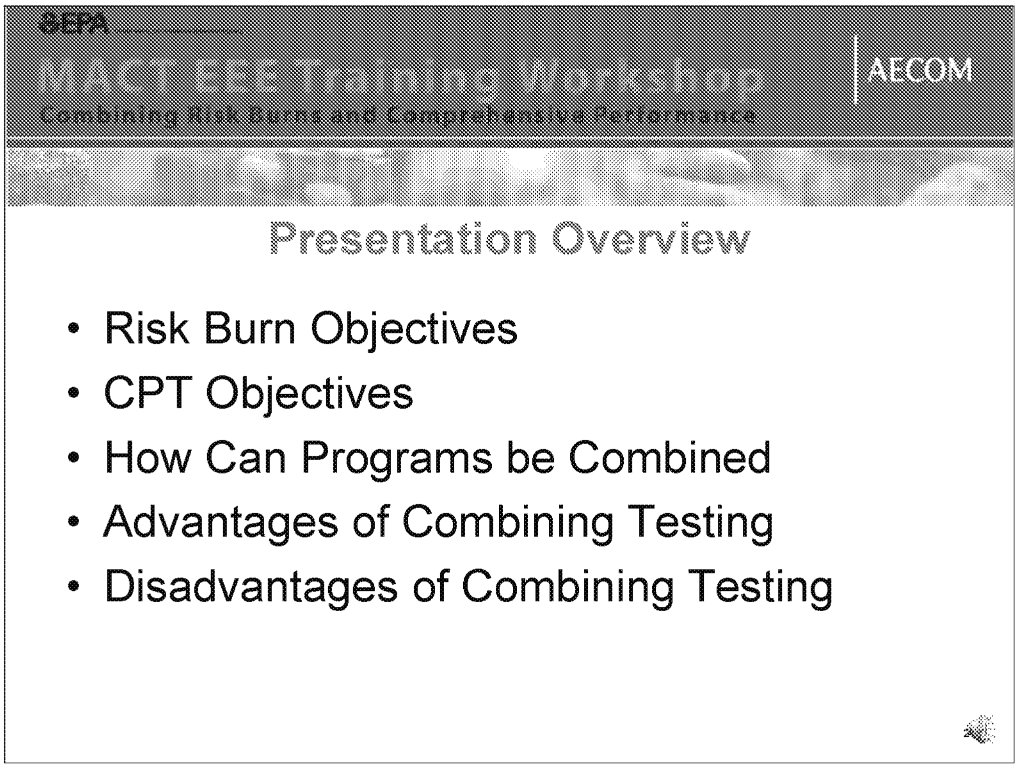
Different HWC facilities calibrate their instrumentation on different frequencies, however this table provides an indication of how a facility might summarize their key CMS components and associated calibrations. In some cases, CMS parameters may be calculations which can be checked for accuracy but cannot be calibrated.



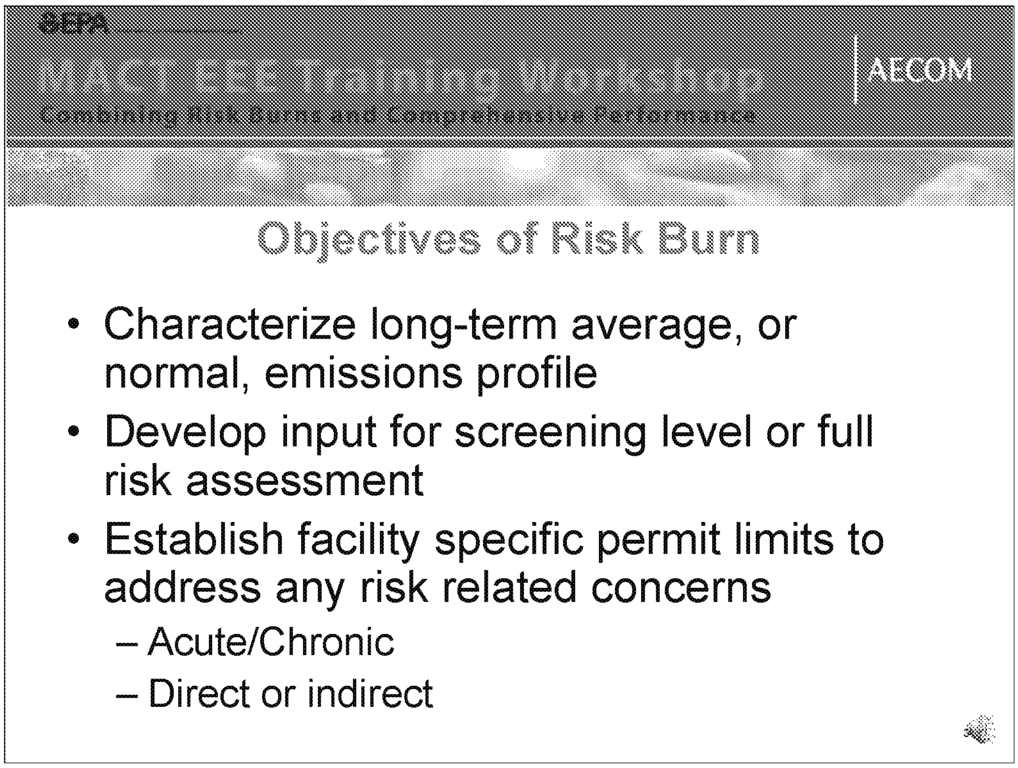
The performance evaluation needs for a specific HWC will be unique to the components that comprise it. However, in general, there are several key features of the CMS that should be reviewed to assure the performance evaluation addresses the critical issues. First is to make sure that all field instruments that are formally part of the Subpart EEE CMS have been audited and calibrated per their appropriate schedule before the CPT is commenced. This should include needed repair or maintenance of deficient components. HWC facilities should also have reviewed their process calculations to make sure that these are being done correctly. A prime example is verifying all calculated feedrates such as metals, ash and chlorine are being totaled correctly and that AWFCOs are set at appropriate levels. It is also suggested that the AWFCO history should be reviewed to understand any ongoing trends or issues that may exist. And finally, all required testing, audits and calibrations for CEMS systems should be current.



This module will discuss the advantages and disadvantages of combining risk burns performed to generate input data for a risk assessment and the HWC MACT Comprehensive Performance Test.



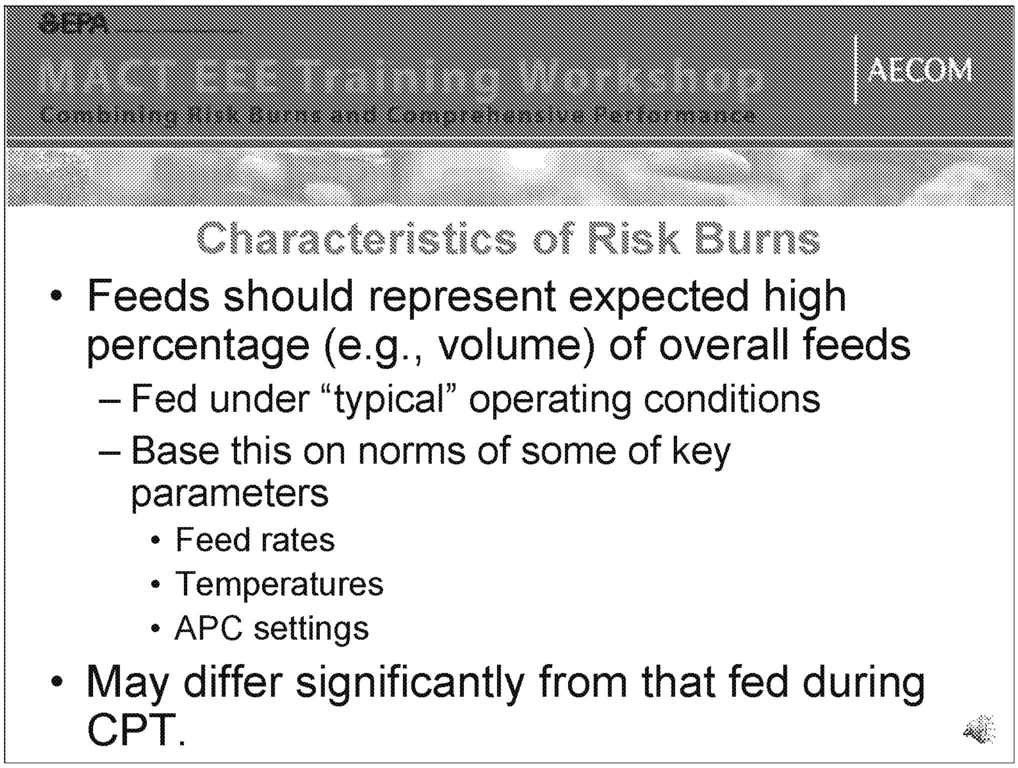
The objectives of both types of programs will be reviewed, the mechanics of how they could be combined will be discussed and then the module will conclude with a discussion of the pros and cons of combing these programs.



The risk burn operating mode affects the outcome of the risk assessment, and may also affect the final permit terms. To assure that the combustor continues to operate within the range where emissions have been found to be protective, the RCRA permit may limit control parameters based on the risk burn. Ultimately, the risk burn generally should strike a balance between operating modes which achieve desired permit flexibility, while also achieving protective emissions levels.

Because the risk assessment evaluates the potential for chronic long-term health impacts, a primary objective of the risk burn is to collect emission data that represent the average emission levels expected over the operating life of the unit. However, the permit should generally ensure that those emissions, on average, are not exceeded over the long term.

Data from the risk burn serve as input for the risk assessment. The risk burn is conducted to establish permit limits that address concerns about potential risk that could be associated with a facility's emissions.

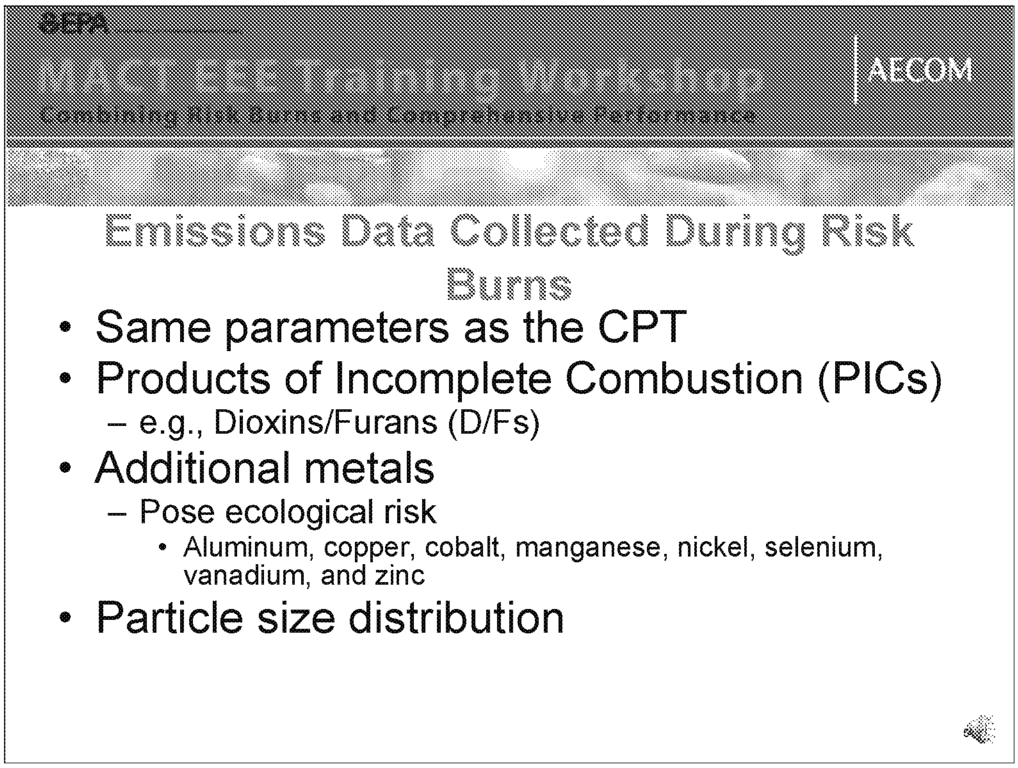


Representative, but challenging feeds should be fed during the risk burn. Representative waste can be defined as those representing a high percentage or volume of overall feeds. Feeds that are burned during the risk burn may differ significantly from those fed during the CPT.

Typically, wastes are fed under "typical" or "normal" operating conditions in a risk burn. These typical operating conditions are generally based on norms of key parameters such as feed rates, temperatures, and air pollution control settings.

While long-term average operating conditions are a good starting point, they are not always the most appropriate conditions for a risk burn. Anyone reviewing a risk burn plan should be cognizant of the potential for the exponential increase in the emission rate of PICs and D/F under certain off-normal conditions that may be, nevertheless, within the allowable operating limits established by the CPT. If such conditions are identified, it may be necessary to incorporate a "normal" frequency of them into the risk burn.

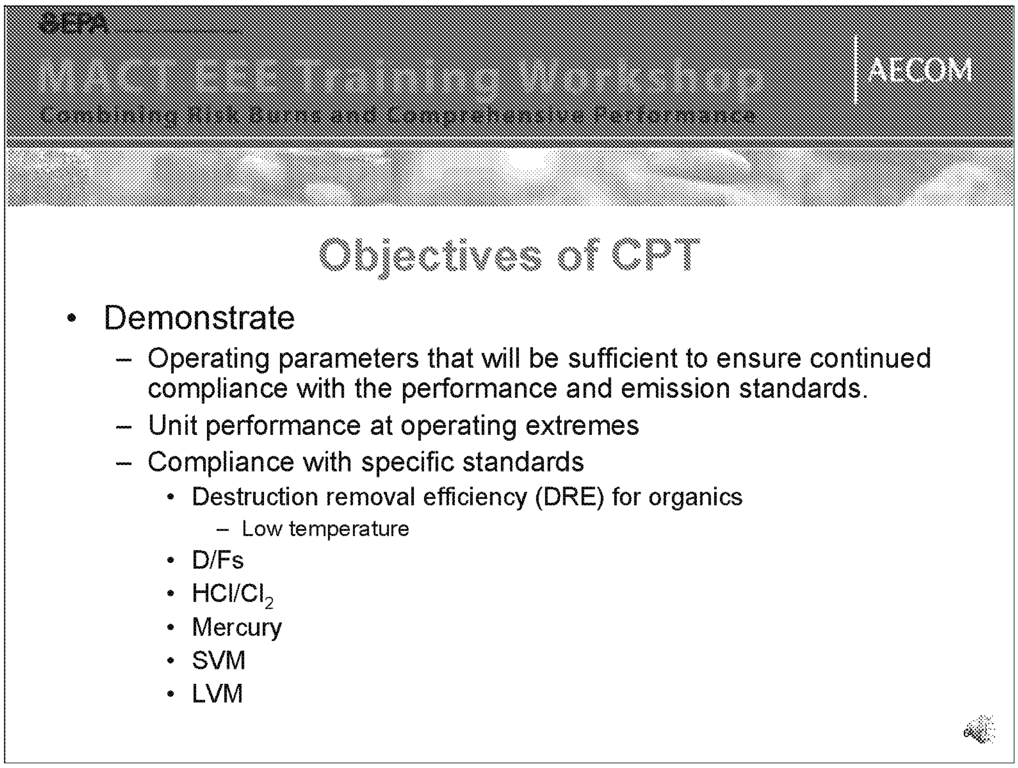
Waste tracking and record keeping could become a condition of the permit.



Much of the data collected during a risk burn is the same as that collected during a CPT. However, additional data to be collected during the risk burn includes volatile and non-volatile products of incomplete combustion.

In addition to the standard metals data collected in a CPT, there are eight additional metals that are compounds of potential concern for ecological receptors. These eight additional metals are aluminum, copper, cobalt, manganese, nickel, selenium, vanadium, and zinc.

Information on particle-size distribution (presented as particle diameters in micrometers, referred to as microns) is needed for the air dispersion and deposition modeling that supports the risk assessments. Because particle dispersion and subsequent deposition are directly related to particle size, potential risks are directly dependent on particle-size distribution.



Comprehensive Performance Tests are typically conducted at extreme "worst-case" operating conditions of the unit in order to define the maximum operating range (or operating envelope) that assures compliance.

As long as the unit continues to operate within the operating envelope demonstrated during a successful CPT, it is presumed to be in compliance with the regulatory performance standards.

Testing at “worst-case” conditions generally involves at least one performance test condition conducted at a minimum combustion temperature to demonstrate Destruction Removal Efficiency. The CPT is also designed to demonstrate compliance with specific standards for:

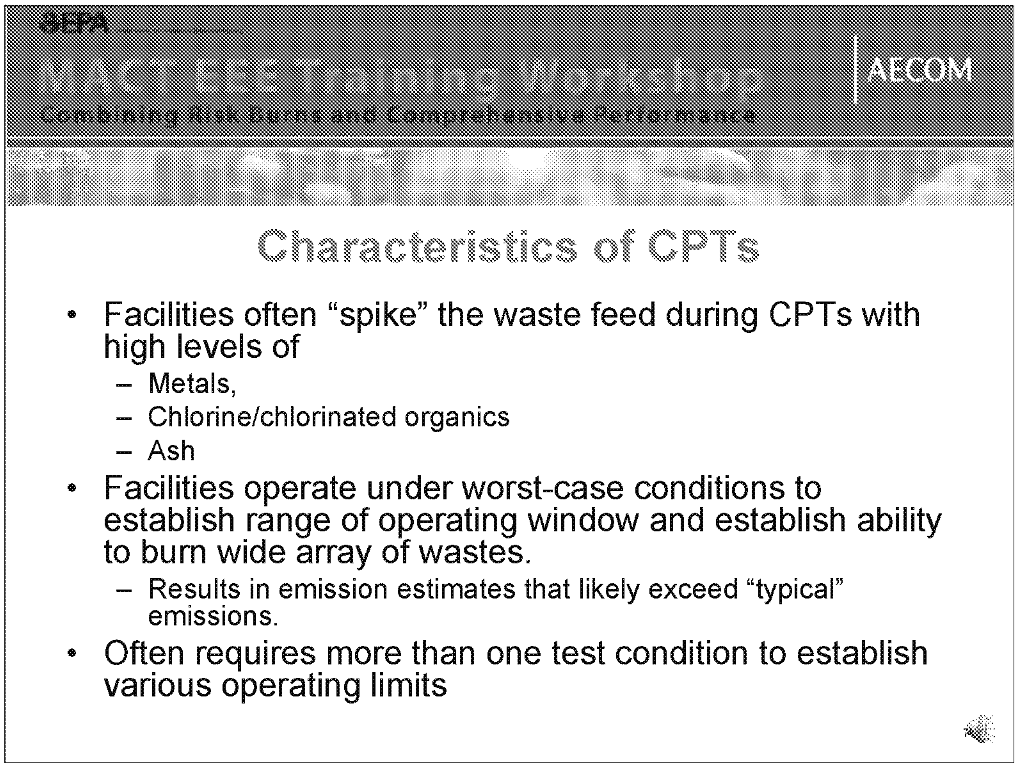
Dioxins/Furans

HCl/Cl_2

Mercury

Semi-Volatility Metals

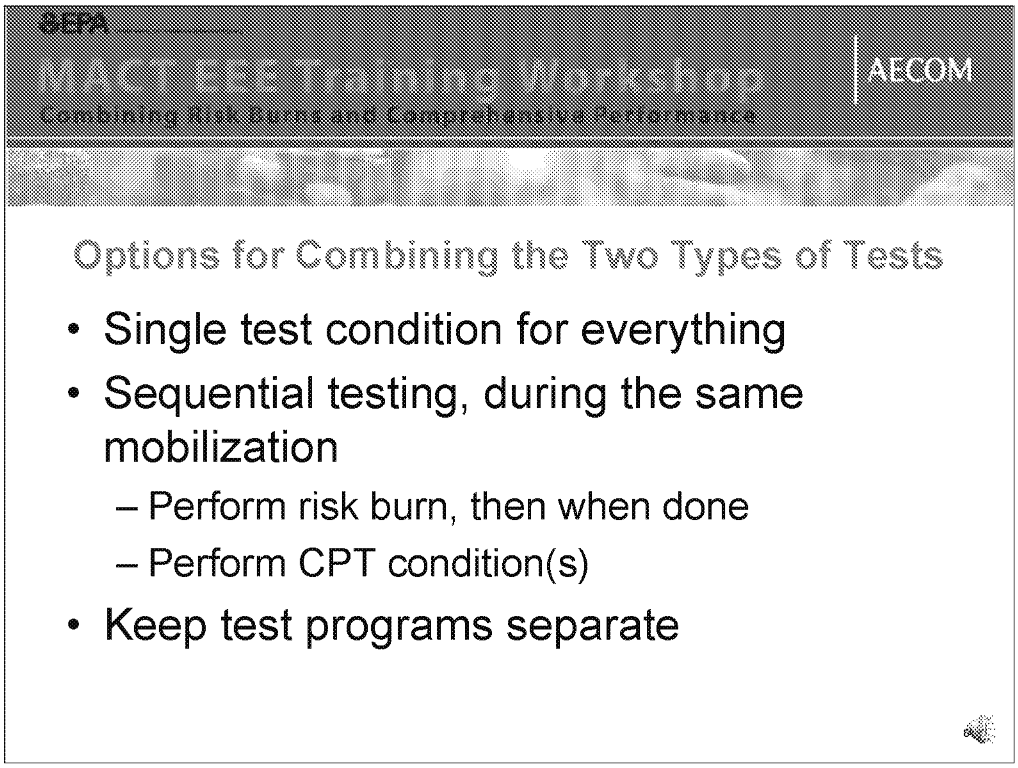
Low-Volatile Metals



Facilities may choose to spike the wastes used during the CPT with metals, chlorine, and ash to demonstrate performance at maximum feed rates. Spiking helps to ensure that sufficiently flexible feed rate limits are established.

When CPTs are conducted under worst-case conditions, a range of operating windows and the ability to burn a wide array of wastes is established. However, performance tests conducted under such conditions also result in emission estimates that are likely to exceed typical daily emission rates.

Conducting CPTs under worst-case conditions usually requires more than one test condition to establish the various operating limits.



Since EPA may consider the results of a risk assessment and use such information to establish risk-based permit limits under the omnibus authority of RCRA as described in 40 CFR § 270.32(b)(2), the risk burn should generally be integrated with trial burn or performance testing to the extent necessary to produce a consistent set of enforceable permit conditions.

There are several options for combining the tests.

A single test condition can be used to collect data on all of the necessary parameters for both the CPT and risk burn. However, the only way in which both compliance and risk data can be derived from a single test is if the facility is certain that risk issues will not arise even when operating under worst case conditions. This is very rare. At almost every facility where data are needed for a risk assessment, tests will have to be done under at least 2 test conditions. (The CPT alone may also require multiple conditions.)

Sequential testing during the same mobilization can be conducted. For example, the risk burn could be conducted and then when that is complete, the CPT could be conducted. However, this option would make for some very long days.

Or, the two test programs can be conducted separately

SEPA

MACT EEE Training Workshop

Combining Risk Burns and Comprehensive Performance

AECOM

Advantages of Combined Testing

- Generally less expensive than separating programs
- Simplified test protocols – have one, instead of two
- Reduces time the HWC is unavailable to operations
- Reduces oversight time on site
- May streamline permit conditions as there might not be need for separate risk related conditions

The advantages of combined testing include:

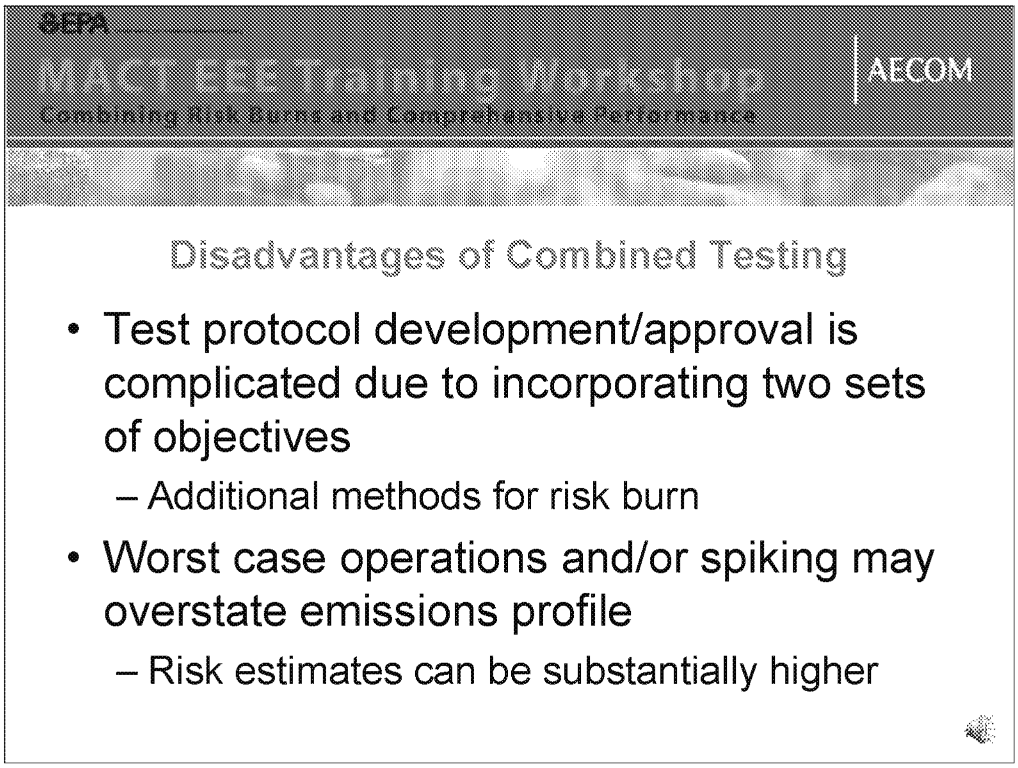
Lower cost, since there is a single mobilization and other efficiencies gained by combined testing.

Simplified test protocols – have one, instead of two

Reduces time the HWC is available to operations

Reduces oversight time on site

May streamline permit conditions as there might not be need for separate risk related conditions



Disadvantages of combined testing include:

Complications that arise as a result of the incorporation of two sets of objectives in the test protocol and obtaining subsequent approval of those differing objectives.

If testing is combined, data for the risk assessment may represent worst-case operations or waste feed characteristics, which may result in estimated risks that are substantially higher.

EPA

MACT EEE Training Workshop

Combining Risk Burns and Comprehensive Performance

AECOM

Advantages of Separate Testing

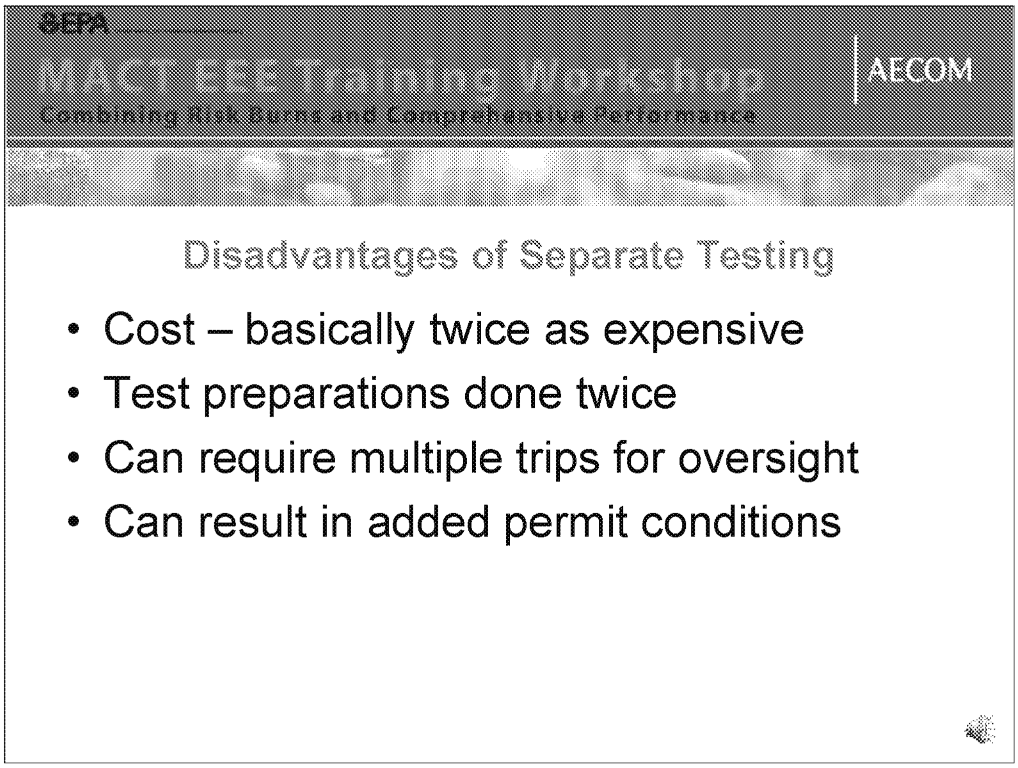
- Each program is simpler to scope
- Can operate HWC consistent with goals of each
  - Worst case for CPT
  - Typical or normal for Risk Burn
- Two reports, keep results separate
  - Easier to review

Advantages of separate testing include:

Each program is easier to scope. separate testing will help avoid logistical conflicts, such as timing.

The combustion unit can be operated consistently with the goals of each testing program. For example, the CPT can be performed under worst-case conditions, while the risk burn is conducted under normal or typical conditions.

The results are kept separate, making review easier



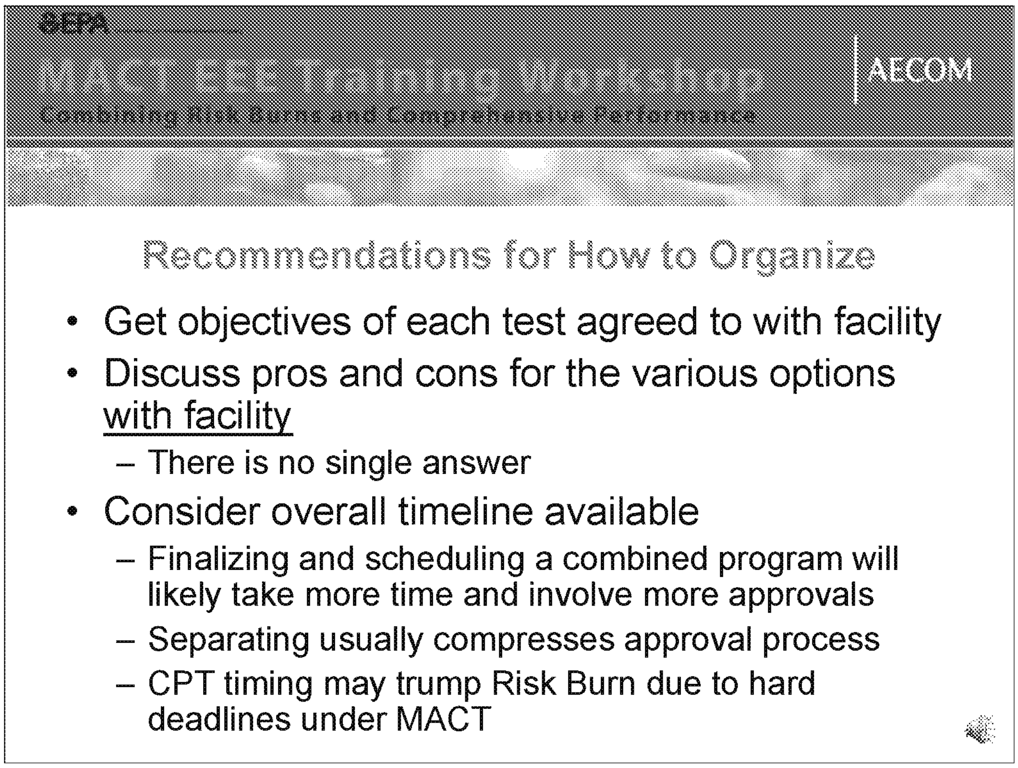
Disadvantages of conducting the testing separately include:

Added cost. In fact, the cost may be double if the two tests are conducted separately.

Test preparations are basically done twice, adding to the cost

Separate tests may require multiple trips for oversight.

Conducting tests separately may result in additional permit conditions. Additional permit limitations may be needed to ensure that conditions represented as normal during the risk burn are, in fact, normal over the long-term operation of the facility.



Planning is critical to ensure that the objectives of the CPT and the risk burn are met. A few recommendations for organizing the testing include:

Getting the objectives of each test agreed upon

Discussing the pros and cons of the various options with facility personnel, as there is no one approach that works best for all facilities.

Considering the overall timeline, keeping in mind that

* Finalizing and scheduling a combined program will likely take more time and involve more approvals

* Separating usually compresses approval process

* CPT timing may trump Risk Burn due to hard deadlines under MACT

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1. *CONTENT OF COMPREHENSIVE PERFORMANCE TEST PLAN*				
1.A ***General***. The source must provide the following:				
1.A.1 63.1207(f)(1)(i) An analysis of each feedstream, including hazardous waste, other fuels, and industrial furnace feedstocks, as fired, that includes:				
1.A.1.a 63.1207(f)(1)(i)(A) Heating value, levels of ash (for hazardous waste incinerators only), levels of semivolatile metals, low volatile metals, mercury, and total chlorine (organic and inorganic); and				
1.A.1.b 63.1207(f)(1)(i)(B) Viscosity or description of the physical form of the feedstream;				
1.A.2 63.1207(f)(1)(ii) For organic hazardous air pollutants established by 42 U.S.C. 7412(b)(1), excluding caprolactam (CAS number 105602) as provided by §63.60:				
1.A.2.a 63.1207(f)(1)(ii)(A) An identification of such organic hazardous air pollutants that are present in the feedstream, except that the source need not analyze for organic hazardous air pollutants that would reasonably not be expected to be found in the feedstream. The source must identify any constituents that it excludes from analysis and explain the basis for excluding them. The source must conduct the feedstream analysis according to §63.1208(b)(8). The source may qualify for reduced analysis in lieu of the feedstream identification required by this section, on a case by case basis, according to the conditions set forth in 63.1207(f)(1)(ii)(D);				
1.A.2.b 63.1207(f)(1)(ii)(B) An approximate quantification of such identified organic hazardous air pollutants in the feedstreams, within the precision produced by the analytical procedures of §63.1208(b)(8); and				
1.A.2.c 63.1207(f)(1)(ii)(C) A description of blending procedures, if applicable, prior to firing the feedstream, including a detailed analysis of the materials prior to blending, and blending ratios;				
1.A.3.d 63.1207(f)(1)(ii)(D) The Administrator may approve on a case-by-case basis a hazardous waste feedstream analysis for organic hazardous air pollutants in lieu of the analysis required under 63.1207(f)(1)(ii)(A) if the reduced analysis is sufficient to ensure that the POHCs used to demonstrate compliance with the applicable DRE standard of 63.1203, 63.1204, and 63.1205 continue to be representative of the organic hazardous air pollutants in the source's hazardous waste feedstreams.				
1.A.3 63.1207(f)(1)(iii) A detailed engineering description of the hazardous waste combustor, including:				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.3.a 63.1207(f)(1)(iii)(A) Manufacturer's name and model number of the hazardous waste combustor;				
1.A.3.b 63.1207(f)(1)(iii)(B) Type of hazardous waste combustor;				
1.A.3.c 63.1207(f)(1)(iii)(C) Maximum design capacity in appropriate. units;				
1.A.3.d 63.1207(f)(1)(iii)(D) Description of the feed system for each feedstream;				
1.A.3.e 63.1207(f)(1)(iii)(E) Capacity of each feed system;				
1.A.3.f 63.1207(f)(1)(iii)(F) Description of automatic hazardous waste feed cutoff system(s);				
1.A.3.g 63.1207(f)(1)(iii)(G) Description of the design, operation, and maintenance practices for any air pollution control system; and				
1.A.3.h 63.1207(f)(1)(iii)(H) Description of the design, operation, and maintenance practices of any stack gas monitoring and pollution control monitoring systems;				
1.A.4 63.1206(b)(12) *Documentation of compliance with the standards based on performance testing.* The source must conduct a minimum of three runs of a performance test required under §63.1207 to document compliance with the emission standards of this subpart.				
1.A.5 63.1207(f)(1)(iv) A detailed description of sampling and monitoring procedures including sampling and monitoring locations in the system, the equipment to be used, sampling and monitoring frequency, and planned analytical procedures for sample analysis. (Note that where applicable, equivalent SW-846 Methods may be used as well.)				
1.A.5.a ***Test Methods***				
1.A.5.a.1 63.1208(b)(2) - (4) *Metals.* The source must use Method 29, provided in appendix A, part 60 of this chapter, to demonstrate compliance with emission standard for cadmium and lead (combined); and arsenic, beryllium, and chromium (combined); and mercury.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.5.a.2 63.1208(b)(6) *Particulate matter.* The source must use Methods 5 or 5i, provided in appendix A, part 60 of this chapter, to demonstrate compliance with the emission standard for particulate matter[1].				
1.A.5.a.3 63.1208(b)(1) *Dioxins and furans*. The source must use Method 0023A, Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans emissions from Stationary Sources, EPA Publication SW-846, as incorporated by reference in paragraph 63.1208(a), to determine compliance with the emission standard for dioxins and furans; The source must sample for a minimum of three hours, and must collect a minimum sample volume of 2.5 dscm; The source may assume that nondetects are present at zero concentration.				
1.A.5.a.4 63.1208(b)(5) *Hydrochloric acid and chlorine gas*. The source may use Methods 26A, 320, or 321 provided in appendix A, part 60 of this chapter, to determine compliance with the emission standard for hydrochloric acid and chlorine gas (combined). The source may use Methods 320 or 321 to make major source determinations under §63.9(b)(2)(v).				
1.A.5.a.5 63.1208(b)(8) *Feedstream analytical methods*. The source may use any reliable analytical method to determine feedstream concentrations of metals, chlorine, and other constituents. It is the source's responsibility to ensure that the sampling and analysis procedures are unbiased, precise, and that the results are representative of the feedstream. For each feedstream, the source must demonstrate that each analyte is not present above the reported level at the 80% upper confidence limit around the mean; and the analysis could have detected the presence of the constituent at or below the reported level at the 80% upper confidence limit around the mean. (See Guidance for Data Quality Assessment–Practical Methods for Data Analysis, EPA QA/G-9, January 1998, EPA/600/R-96/084).				
1.A.5.b 63.7(c) *Quality Assurance Program*. A Quality Assurance Project Plan (QAPP) should be included for all the proposed analytical work[2].				

[1]**Footnote to 1.A.5.a.2:** The selection of the method depends on the expected PM emissions level during the performance test. In cases of low levels of particulate matter (i.e., for total train catches of less than 50 mg), it is recommended that Method 5i be used. For higher emissions, Method 5 may be used. Note that this total train catch is not intended to be a data acceptance criterion. Thus, total train catches exceeding 50 mg do not invalidate the method. In practice this will likely mean that all incinerators and most lightweight aggregate kilns will use Method 5i for compliance, while some lightweight aggregate kilns and some cement kilns will use Method 5. Note that Method 5i has been shown to have better precision than Method 5. *(Technical Support Document Volume IV)*

[2]**Footnote to 1.A.5.b:** The QAPP should consider and be developed in accordance with such EPA documents as (1) *Region 5 policy for Developing Quality Assurance Project Plans* (available from www.epa.gov/region5/rcraca/guidance.htm); (2) *QA/QC Procedures for Hazardous Waste Incineration* (EPA 625-6-89-023); and (3) Component 2 f Region 6's *Hazardous Waste Combustion Unit Permitting Manual* (available at www.epa.gov/earth1r6/6pd/rcra_c/manual/manual.htm)

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.5.b.1 63.7(c)(2)(i) The test plan must include a test program summary, the test schedule, data quality objectives, and both an internal and external quality assurance (QA) program. Data quality objectives are the pretest expectations of precision, accuracy, and completeness of data.				
1.A.5.b.2 63.7(c)(2)(ii) The internal QA program shall include, at a minimum, the activities planned by routine operators and analysts to provide an assessment of test data precision; an example of internal QA is the sampling and analysis of replicate samples.				
1.A.5.b.3 63.7(c)(2)(iii) The external QA program shall include, at a minimum, application of plans for a test method performance audit (PA) during the performance test. The PA's consist of blind audit samples provided by the Administrator and analyzed during the performance test in order to provide a measure of test data bias. The external QA program may also include systems audits that include the opportunity for onsite evaluation by the Administrator of instrument calibration, data validation, sample logging, and documentation of quality control data and field maintenance activities.				
1.A.6 63.1207(f)(1)(v) A detailed test schedule for each hazardous waste for which the performance test is planned, including date(s), duration, quantity of hazardous waste to be burned, and other relevant factors;				
1.A.7 63.1207(f)(1)(vi) A detailed test protocol, including, for each hazardous waste identified, the ranges of hazardous waste feedrate for each feed system, and, as appropriate, the feedrates of other fuels and feedstocks, and any other relevant parameters that may affect the ability of the hazardous waste combustor to meet the emission standards				
1.A.8 63.1207(f)(1)(vii) A description of, and planned operating conditions for, any emission control equipment that will be used;				
1.A.9 63.1207(f)(1)(viii) Procedures for rapidly stopping the hazardous waste feed and controlling emissions in the event of an equipment malfunction;				
1.A.10 63.1207(f)(1)(ix) and 63.1206(b)(11) A determination of the hazardous waste residence time;				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.11 63.1207(f)(1)(x) If the source is requesting to extrapolate metal feedrate limits from comprehensive performance test levels under 63.1209(l)(1)(i) or 63.1209(n)(2)(ii)(A):				
1.A1.11.a 63.1207(f)(1)(x)(A) A description of the extrapolation methodology and rationale for how the approach ensures compliance with the emission standards;				
1.A.11.b 63.1207(f)(1)(x)(B) Documentation of the historical range of normal (i.e., other than during compliance testing) metals feedrates for each feedstream;				
1.A.11.c 63.1207(f)(1)(x)(C) Documentation that the level of spiking recommended during the performance test will mask sampling and analysis imprecision and inaccuracy to the extent that extrapolation of feedrates limits adequately assure compliance with the emission standards.				
1.A.12 63.1207(f)(1)(xi) If the source does not continuously monitor regulated constituents in natural gas, process air feedstreams, and feedstreams from vapor recovery systems under 63.1209(c)(5), it must include documentation of the expected levels of regulated constituents in those feedstreams;				
1.A.13 63.1207(f)(1)(xii) Documentation justifying the duration of system conditioning required to ensure the combustor has achieved steady-state operations under performance test operating conditions, as provided by paragraph (g)(1)(iii) of this section;				
1.A.14 63.1207(f)(1)(xiii) For cement kilns with in-line raw mills, if the source elects to use the emissions averaging provision of 63.1204(d), it must notify the Administrator of its intent in the initial (and subsequent) comprehensive performance test plan, and provide the information required under 63.1204(d)(ii)(B).				
1.A.15 63.1207(f)(1)(xiv) For preheater or preheater/precalciner cement kilns with dual stacks, if the source elects to use the emissions averaging provision of 63.1204(e), it must notify the Administrator of its intent in the initial (and subsequent) comprehensive performance test plan, and provide the information required under 63.1204(e)(2)(iii)(A).				
1.A.16 63.1207(f)(1)(xv) For incinerators and lightweight aggregate kilns equipped with a baghouse, the source must submit the baghouse operation and maintenance plan required under 63.1206(c)(7)(ii)with the initial comprehensive performance test plan.				
1.A.17 63.1207(f)(1)(xvi) If the source is not required to conduct performance testing to document compliance with the mercury, semivolatile metal, low volatile metal, or hydrochloric acid/chlorine gas emission standards under paragraph 63.1207(m), it must include with the comprehensive performance test plan documentation of compliance with the provisions of that section. (Also see section 2.A of this checklist)				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.18 63.1207(f)(1)(xvii) If the source proposes to use a surrogate for measuring or monitoring gas flowrate, it must document in the comprehensive performance test plan that the surrogate adequately correlates with gas flowrate, as required by paragraph 63.1207(m)(7), and 63.1209(j)(2), (k)(3), (m)(2)(i), (n)(5)(i),and (o)(2)(i).				
1.A.19 63.1207(f)(1)(xviii) The source must submit an application to request alternative monitoring under 63.1209(g)(1) not later than with the comprehensive performance test plan, as required by 63.1209(g)(1)(iii)(A). (Also see section 2.D of this checklist)				
1.A.20 63.1207(f)(1)(xix) The source must document the temperature measurement location in the comprehensive performance test plan. As required by 63.1209(j)(1)(i) and 63.1209(k)(2)(i), the source must measure the temperature of each combustion chamber at a location that best represents, as practicable, the bulk gas temperature in the combustion zone.				
1.A.21 63.1207(f)(1)(xx) If the source is equipped with activated carbon injection, it must document in the comprehensive performance test plan (Also see section 1.C.2.f of this checklist				
1.A.21.a 63.1207(f)(1)(xx)(A) The manufacturer specifications for minimum carrier fluid flowrate or pressure drop, as required by 63.1209(k)(6)(ii); and				
1.A.21.b 63.1207(f)(1)(xx)(B) Key parameters that affect carbon adsorption, and the operating limits the source establishes for those parameters based on the carbon used during the performance test, if the source elects not to specify and use the brand and type of carbon used during the comprehensive performance test, s required by 63.1209(k)(6)(iii).				
1.A.22 63. 1207(f)(xxi) If the source is equipped with a carbon bed test system, it must include in the comprehensive performance test plan (Also see section 1.C.2.g of this checklist):				
1.A.22.a 63.1207(f)(1)(xxi)(A) A recommended schedule for conducting a subsequent performance test to document compliance with the dioxin/furan and mercury emission standards if the source uses manufacturer specifications rather than actual bed age at the time of the test to establish the initial limit on bed age, as required by 63.1209(k)(7)(i)(C); and				
1.A.22.b 63.1207(f)(1)(xxi)(B) Key parameters that affect carbon adsorption, and the operating limits the source establishes for those parameters based on the carbon used during the performance test, if the source elects not to specify and use the brand and type of carbon used during the comprehensive performance test, as required by 63.1209(k)(7)(ii).				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.23 63.1207(f)(1)(xxii) <u>If the source feeds a dioxin/furan inhibitor</u> into the combustion system, it must document in the comprehensive performance test plan key parameters that affect the effectiveness of the inhibitor, and the operating limits it establishes for those parameters based on the inhibitor fed during the performance test, if the source elects not to specify and use the brand and type of inhibitor used during the comprehensive performance test, as required by 63.1209(k)(9)(ii). (Also see section 1.C.2.i of this checklist)				
1.A.24 63.1207(f)(1)(xxiii) <u>If the source is equipped with a wet scrubber</u> and it elects to monitor solids content of the scrubber liquid manually but believes that hourly monitoring of solids content is not warranted, the source must support an alternative monitoring frequency in the comprehensive performance test plan, as required by 63.1209(m)(1)(i)(B)(1)(i). (Also see section 1.C.4.a.1.b of this checklist				
1.A.25 63.1207(f)(1)(xxiv) If the source is equipped with a particulate matter control <u>device other than a wet scrubber, baghouse, or electrostatic precipitator</u>, it must include in the comprehensive performance test plan (Also see section 1.C.4.a.4 of this checklist):				
1.A.25.a 63.1207(f)(1)(xxiv)(A) Documentation to support the operating parameter limits the source establishes for the control device, as required by 63.1209(m)(1)(iv)(A)(4); and				
1.A.25.b 63.1207(f)(1)(xxiv)(B) Support for the use of manufacturer specifications if the source recommends such specifications in lieu of basing operating limits on performance test operating levels, as required by 63.1209(m)(1)(iv)(D).				
1.A.26 63.1207(f)(1)(xxv) <u>If the source is equipped with a dry scrubber to control hydrochloric acid and chlorine gas</u>, it must document in the comprehensive performance test plan key parameters that affect adsorption, and the limits it establishes for those parameters based on the sorbent used during the performance test, if the source elects not to specify and use the brand and type of sorbent used during the comprehensive performance test, as required by 63.1209(o)(4)(iii)(A) (also see section 1.C.6.d of this checklist); and				
1.A.27 63.1209(a)(7) <u>*Operating parameter limits for hydrocarbons*</u>. If you elect to comply with the carbon monoxide and hydrocarbon emission standards by continuously monitoring carbon monoxide with a CEMS, you must demonstrate that hydrocarbon emissions during the comprehensive performance test do not exceed the hydrocarbon emissions standard. In addition, the limits you establish on the destruction and removal efficiency (DRE) operating parameters required under 63.1209(j) also ensure that you maintain compliance with the hydrocarbon emission standard. If you do not conduct the hydrocarbon demonstration and DRE tests concurrently, you must establish separate operating parameter limits under 63.1209(j) based on each test and the more restrictive of the operating parameter limits applies.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.A.28 63.1207(f)(1)(xxvi) For purposes of calculating semivolatile metal; low volatile metal, mercury, and total chlorine (organic and inorganic), and ash federate limits, a description of how the source will handle performance test feedstream analytical results that determines these constituents are not present at detectable levels.				
1.B *Operating conditions during testing*.				
1.B.1 63.1207(g)(1)(i) *Operations during testing*. For the following parameters, the source must operate the combustor during the performance test under normal conditions (or conditions that will result in higher than normal emissions):				
1.B.1.a 63.1207(g)(1)(i)(A) *Chlorine feedrate.* The source must feed normal (or higher) levels of chlorine during the dioxin/furan performance test;				
1.B.1.b 63.1207(g)(1)(i)(B) *Ash feedrate.* For hazardous waste incinerators, the source must conduct the following tests when feeding normal (or higher) levels of ash; the semivolatile metal and low volatile metal performance tests; and the dioxin/furan and mercury performance tests; and the dioxin/furan and mercury performance tests if activated carbon injection of a carbon bed is used.				
1.B.1.c 63.1207(g)(1)(i)(C) *Cleaning cycle of the particulate matter control device.* The source must conduct the following tests when the particulate matter control device undergoes its normal (or more frequent) cleaning cycle: the particulate matter, semivolatile metal, and low volatile metal performance tests; and the dioxin/furan and mercury performance tests if activated carbon injection or a carbon bed is used				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C *Specific Monitoring Requirements During Performance Test*				
1.C.1 63.1209(j) *DRE.* The source must establish operating limits during the comprehensive performance test (or during a previous DRE test under provisions of §63.1206(b)(7)) for the following parameters, unless the limits are based on manufacturer specifications, and comply with those limits at all times that hazardous waste remains in the combustion chamber (i.e., the hazardous waste residence time has not transpired since the hazardous waste feed cutoff system was activated):				
1.C.1.a 63.1209(j)(1) *Minimum combustion chamber temperature.* The source must measure the temperature of each combustion chamber at a location that best represents, as practicable, the bulk gas temperature in the combustion zone. The source must document the temperature measurement location in the test plan (See 1.A.20);	See 1. A. 20			
1.C.1.b 63.1209(j)(2) *Maximum flue gas flowrate or production rate.* As an indicator of gas residence time in the control device, the source must establish and comply with a limit on the maximum flue gas flowrate, the maximum production rate, or another parameter that the source documents in the site-specific test plan as an appropriate surrogate for gas residence time, as the average of the maximum hourly rolling averages for each run.				
1.C.1.c 63.1209(j)(3) *Maximum hazardous waste feedrate.* The source must establish limits on the maximum pumpable and total (i.e., pumpable and nonpumpable) hazardous waste feedrate for each location where hazardous waste is fed.				
1.C.1.d 63.1209(j)(4) *Operation of waste firing system.* The source must specify operating parameters and limits to ensure that good operation of each hazardous waste firing system is maintained.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.2 63.1209(k) _Dioxins and furans_. The source must comply with the dioxin and furans emission standard by establishing and complying with the following operating parameter limits. The source must base the limits on operations during the comprehensive performance test, unless the limits are based on manufacturer specifications.				
1.C.2.a 63.1209(k)(1) _Gas temperature at the inlet to a dry particulate matter control device_				
1.C.2.a.1 63.1209(k)(1)(i) For hazardous waste burning incinerators and cement kilns, if the combustor is equipped with an electrostatic precipitator, baghouse (fabric filter), or other dry emissions control device where particulate matter is suspended in contact with combustion gas, the source must establish a limit on the maximum temperature of the gas at the inlet to the device on an hourly rolling average. The source must establish the hourly rolling average limit as the average of the test run averages.				
1.C.2.a.2 63.1209(k)(1)(ii) For hazardous waste burning lightweight aggregate kilns, the source must establish a limit on the maximum temperature of the gas at the exit of the (last) combustion chamber (or exit of any waste heat recovery system) on an hourly rolling average. The limit must be established as the average of the test run averages;				
1.C.2.b 63.1209(k)(2) _Minimum combustion chamber temperature_. The source must measure the temperature of each combustion chamber at a location that best represents, as practicable, the bulk gas temperature in the combustion zone. The source must document the temperature measurement location in the test plan (See 1.A.20 and 1.C.1.a); See 1.A.20	See 1.A.20			
1.C.2.c 63.1209(k)(3) _Maximum flue gas flowrate or production rate._ As an indicator of gas residence time in the control device, the source must establish and comply with a limit on the maximum flue gas flowrate, the maximum production rate, or another parameter that the source documents in the site-specific test plan as an appropriate surrogate for gas residence time, as the average of the maximum hourly rolling averages for each run. The source must comply with this limit on a hourly rolling average basis (See 1.C.1.b);				
1.C.2.d 63.1209(k)(4) _Maximum waste feedrate_. The source must establish limits on the maximum pumpable and total (pumpable and nonpumpable) waste feedrate for each location where waste is fed. The source must establish the limits as the average of the maximum hourly rolling averages for each run. The source must comply with the feedreate limit(s) on a hourly rolling average basis (See 1.C.1.c);				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.2.e 63.1209(k)(5) *Particulate matter operating limit*. If the combustor is equipped with an activated carbon injection, the source must establish operating parameter limits on the particulate matter control device as specified by paragraph (m)(1) of this (See 1.C.4.a);				
1.C.2.f 63.1209(k)(6) *Activated carbon injection parameter limits*. If the combustor is equipped with an activated carbon injection system (see 1.A.21):				
1.C.2.f.1 63.1209(k)(6)(i) *Carbon feedrate*. The source must establish a limit on minimum carbon injection rate on an hourly rolling average calculated as the average of the test run averages. If the carbon injection system injects carbon at more than one location, the source must establish a carbon feedrate limit for each location.				
1.C.2.f.2 63.1209(k)(6)(ii) *Carrier fluid*. The source must establish a limit on minimum carrier fluid (gas or liquid) flowrate or pressure drop as an hourly rolling average based on the manufacturer's specifications. The source must document the specifications in the test plan;				
1.C.2.f.3 63.1209(k)(6)(iii) *Carbon specification.* The source must specify and use the brand (i.e., manufacturer) and type of carbon used during the comprehensive performance test until a subsequent comprehensive performance test is conducted, unless the source documents in the site-specific performance test plan key parameters that affect adsorption and establish limits on those parameters based on the carbon used in the performance test[3].				
1.C.2.g 63.1209(k)(7) *Carbon bed parameter limits.* If the combustor is equipped with a carbon bed system (See 1.A.22):				

[3]**Footnote to 1.C.2.f.3:** Under 63.1209(k)(6)(iii)(B) The source may substitute at any time a different brand or type of carbon provided that the replacement has equivalent or improved properties compared to the carbon used in the performance test and conforms to the key sorbent parameters the source identifies under paragraph (k)(6)(iii)(A) of this section. The source must include in the operating record documentation that the substitute carbon will provide the same level of control as the original carbon.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.2.g.1 63.1209(k)(7)(i) *Maximum bed life.* The source must monitor performance of the carbon bed consistent with manufacturer's specifications and recommendations to ensure the carbon bed (or bed segment for sources with multiple segments) has not reached the end of its useful life to minimize dioxin/furan and mercury emissions at least to the levels required by the emission standards. The source must document the procedures in the operations and maintenance plan. The source must record results of the performance monitoring in the operating record. The source must replace the bed or bed segment before it has reached the end of its useful life to minimize dioxin/furan and mercury emissions at least to the levels required by the emission standards.				
1.C.2.g.2 63.1209(k)(7)(ii) *Carbon specification.* The source must specify and use the brand (i.e., manufacturer) and type of carbon used during the comprehensive performance test until a subsequent comprehensive performance test is conducted, unless it documents in its site-specific performance test plan required under §§63.1207(e) and (f) key parameters that affect adsorption and establish limits on those parameters based on the carbon used in the performance test[4].				
1.C.2.g.3 63.1209(k)(7)(iii) *Maximum temperature*. The source must measure the temperature of the carbon bed at either the bed inlet or exit, and must establish a maximum temperature limit on an hourly rolling average as the average of the test run averages.				
1.C.2.h 63.1209(k)(8) *Catalytic oxidizer parameter limits*. If the combustor is equipped with a catalytic oxidizer, the source must establish limits on the following parameters:				

[4]**Footnote to 1.C.2.g.2:** Under 63.1209(k)(7)(ii)(B) the source may substitute at any time a different brand or type of carbon provided that the replacement has equivalent or improved properties compared to the carbon used in the performance test. The source must include in the operating record documentation that the substitute carbon will provide an equivalent or improved level of control as the original carbon.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.2.h.1 63.1209(k)(8)(i) *Minimum flue gas temperature at the entrance of the catalyst.* The source must establish a limit on minimum flue gas temperature at the entrance of the catalyst on an hourly rolling average as the average of the test run averages				
1.C.2.h.2 63.1209(k)(8)(ii) *Maximum time in-use*. The source must replace a catalytic oxidizer with a new catalytic oxidizer when it has reached the maximum service time specified by the manufacturer				
1.C.2.h.3 63.1209(k)(8)(iii) *Catalyst replacement specifications*. When the source replaces a catalyst with a new one, the new catalyst must be equivalent to or better than the one used during the previous comprehensive test, as measured by (1) catalytic metal loading for each metal; (2) space time, expressed in the units s^{-1}, the maximum rated volumetric flow of combustion gas through the catalyst divided by the volume of the catalyst; and (3) substrate construction, including materials of construction, washcoat type, and pore density				
1.C.2.h.4 63.1209(k)(8)(iv) *Maximum flue gas temperature*. The source must establish a maximum flue gas temperature limit at the entrance of the catalyst as an hourly rolling average, based on manufacturer's specifications.				
1.C.2.i 63.1209(k)(9) *Inhibitor feedrate parameter limits*. If the source feeds a dioxin/furan inhibitor into the combustion system, it must establish limits for the following parameters (See 1.A.23):				
1.C.2.i.1 63.1209(k)(9)(i) *Minimum inhibitor feedrate*. The source must establish a limit on minimum inhibitor feedrate on an hourly rolling average as the average of the test run averages.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.2.i.2 63.1209(k)(9)(ii) *Inhibitor specifications.* The source must specify and use the brand (i.e., manufacturer) and type of inhibitor used during the comprehensive performance test until a subsequent comprehensive performance test is conducted, unless the source documents in the site-specific performance test plan key parameters that affect the effectiveness of the inhibitor and establish limits on those parameters based on the inhibitor used in the performance test[5].				
1.C.3 63.1209(l) *Mercury.* The source must comply with the mercury emission standard by establishing and complying with the following operating parameter limits. The source must base the limits on operations during the comprehensive performance test, unless the limits are based on manufacturer specifications				
1.C.3.a 63.1209(l)(1) *Feedrate of total mercury.* The source must establish a 12-hour rolling average limit for the total feedrate of mercury in all feedstreams as the average of the test run averages, unless mercury feedrate limits are extrapolated from performance test feedrate levels under the following provisions.				
1.C.3.a.1 63.1209(l)(1)(i) The source may request as part of the performance test plan under 63.7(b) and (c) and 63.1207(e) and (f) to use the mercury feedrates and associated emission rates during the comprehensive performance test to extrapolate to higher allowable feedrate limits and emission rates. Under 63.1209(l)(1)(ii), the extrapolation methodology will be reviewed and approved, as warranted, by the Administrator. The review will consider in particular whether:				
1.C.3.a.1.a 63.1209(l)(1)(ii)(A) Performance test metal feedrates are appropriate (i.e., whether feedrates are at least at normal levels; depending on the heterogeneity of the waste, whether some level of spiking would be appropriate; and whether the physical form and species of spiked material is appropriate); and				

[5] **Footnote to 1.C.2.i.2:** Under 63.1209(k)(9)(ii)(B) the source may substitute at any time a different brand or type of inhibitor provided that the replacement has equivalent or improved properties to the inhibitor used in the performance test and conforms to the key parameters the source identifies under paragraph (k)(9)(ii)(A) of this section. The source must include in the operating record documentation that the substitute inhibitor will provide the same level of control as the original inhibitor.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.3.a.1.b 63.1209(l)(1)(ii)(B) Whether the extrapolated feedrates the source is requesting are warranted considering historical metal feedrate data. Note that under 63.1209(l)(1)(iii), the Administrator will review the performance test results in making a finding of compliance required by §§63.6(f)(3) and 63.1206(b)(3) to ensure that the source has interpreted emission test results properly and that the extrapolation procedure is appropriate for the combustor.				
1.C.4 63.1209(m) *Particulate matter.* The source must comply with the particulate matter emission standard by establishing and complying with the following operating parameter limits. The source must base the limits on operations during the comprehensive performance test, unless the limits are based on manufacturer specifications.				
1.C.4.a 63.1209(m)(1) *Control device operating parameter limits.*				
1.C.4.a.1 63.1209(m)(1)(i) *Wet scrubbers.* For sources equipped with wet scrubbers, including ionizing wet scrubbers, high energy wet scrubbers such as venturi, hydrosonic, collision, or free jet wet scrubbers, and low energy wet scrubbers such as spray towers, packed beds, or tray towers, the source must establish limits on the following parameters:				
1.C.4.a.1.a 63.1209(m)(1)(i)(A) For high energy scrubbers only, minimum pressure drop across the wet scrubber on an hourly rolling average, established as the average of the test run averages;				
1.C.4.a.1.b 63.1209(m)(1)(i)(B) For all wet scrubbers (See 1.A.24):				
1.C.4.a.1.b.1 63.1209(m)(1)(i)(B)(*1*) To ensure that the solids content of the scrubber liquid does not exceed levels during the performance test, the source must either (1) establish a limit on solids content of the scrubber liquid using a CMS or by manual sampling and analysis, or (2) establish a minimum blowdown rate using a CMS and either a minimum scrubber tank volume or liquid level using a CMS. If the source elects to monitor solids content manually, it must sample and analyze the scrubber liquid hourly unless it supports an alternative monitoring frequency in the performance test plan that it submits for review and approval; or				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.4.a.1.b.2 63.1209(m)(1)(i)(B)(*2*) For maximum solids content monitored with a CMS, the source must establish a limit on a twelve-hour rolling average as the average of the test run averages.				
1.C.4.a.1.b.3 63.1209(m)(1)(i)(B)(*3*) For maximum solids content measured manually, the source must establish an hourly limit, as measured at least once per hour, unless it supports an alternative monitoring frequency in the performance test plan that it submits for review and approval. The source must establish the maximum hourly limit as the average of the manual measurement averages for each run.				
1.C.4.a.1.b.4 63.1209(m)(1)(i)(B)(*4*) For minimum blowdown rate and either a minimum scrubber tank volume or liquid level using a CMS, the source must establish a limit on an hourly rolling average as the average of the test run averages.				
1.C.4.a.1.c 63.1209(m)(1)(i)(C) For high energy wet scrubbers only, the source must establish limits on either the minimum liquid to gas ratio or the minimum scrubber water flowrate and maximum flue gas flowrate on an hourly rolling average. If the source establishes limits on maximum flue gas flowrate under this paragraph, it need not establish a limit on maximum flue gas flowrate under paragraph (m)(2) of this section. The source must establish these hourly rolling average limits as the average of the test run averages; and				
1.C.4.a.1.d 63.1209(m)(1)(i)(D) **This requirement has been deleted.**				
1.C.4.a.2 63.1209(m)(1)(iv) *Other particulate matter control devices*. For each control device that is not a high energy or ionizing wet scrubber, baghouse, or electrostatic precipitator but is operated to comply with the particulate matter emission standards of this subpart, the source must ensure that the control device is properly operated and maintained as required by §63.1206(c)(7) (*i.e.*, requirements for an Operation and Maintenance Plan) and by monitoring the operation of the control device as follows (See 1.A.25):				
1.C.4.a.2.a 63.1209(m)(1)(iv)(A) During each comprehensive performance test conducted to demonstrate compliance with the particulate matter emissions standard, the source must establish a range of operating values for the control device that is a representative and reliable indicator that the control device is operating within the same range of conditions as during the performance test. The source must establish this range of operating values as follows:				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.4.a.2.a.1 63.1209(m)(1)(iv)(A)(*1*) The source must select a set of operating parameters appropriate for the control device design that the source determines to be a representative and reliable indicator of the control device performance.				
1.C.4.a.2.a.2 63.1209(m)(1)(iv)(A)(*2*) The source must measure and record values for each of the selected operating parameters during each test run of the performance test. A value for each selected parameter must be recorded using a continuous monitor.				
1.C.4.a.2.a.3 63.1209(m)(1)(iv)(A)(*3*) For each selected operating parameter measured in accordance with the requirements of paragraph (m)(1)(iv)(A)(*1*) of this section, the source must establish a minimum operating parameter limit or a maximum operating parameter limit, as appropriate for the parameter, to define the operating limits within which the control device can operate and still continuously achieve the same operating conditions as during the performance test.				
1.C.4.a.2.a.4 63.1209(m)(1)(iv)(A)(*4*) The source must prepare written documentation to support the operating parameter limits established for the control device and the source must include this documentation in the performance test plan that it submits for review and approval. This documentation must include a description for each selected parameter and the operating range and monitoring frequency required to ensure the control device is being properly operated and maintained.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.4.a.2.b 63.1209(m)(1)(iv)(B) The source must install, calibrate, operate, and maintain a monitoring device equipped with a recorder to measure the values for each operating parameter selected in accordance with the requirements of 63.1209(m)(1)(iv)(A)(*1*). The recorder must record the detector responses at least every 60 seconds. Per 63.1209(m)(1)(iv)(D), operating parameters selected in accordance with (m)(1)(iv) of this section may be based on manufacturer specifications provided the source supports the use of manufacturer specifications in the performance test plan that it submits for review and approval[6].				
1.C.4.b 63.1209(m)(2) *Maximum flue gas flowrate or production rate*. As an indicator of gas residence time in the control device, the source must establish a limit on the maximum flue gas flowrate, the maximum production rate, or another parameter that it documents in the site-specific test plan as an appropriate surrogate for gas residence time, as the average of the maximum hourly rolling averages for each run. The source must comply with this limit on a hourly rolling average basis (see 1.C.1.b);				
1.C.4.c 63.1209(m)(3) *Maximum ash feedrate.* Owners and operators of hazardous waste incinerators must establish a maximum ash feedrate limit as the average of the test run averages (See 1.B.1.b).				
1.C.5 63.1209(n) *Semivolatile metals and low volatility metals.* The source must comply with the semivolatile metal (cadmium and lead) and low volatile metal (arsenic, beryllium, and chromium) emission standards by establishing and complying with the following operating parameter limits. The source must base the limits on operations during the comprehensive performance test, unless the limits are based on manufacturer specifications.				
1.C.5.a 63.1209(n)(1) *Maximum inlet temperature to dry particulate matter air pollution control device*. The source must establish a limit on the maximum inlet temperature to the primary dry metals emissions control device (e.g., electrostatic precipitator, baghouse) on an hourly rolling average basis as the average of the test run averages (See 1.C.2.a).				
1.C.5.b 63.1209(n)(2) *Maximum feedrate of semivolatile and low volatile metals.*				

[6]**Footnote to 1.C.4.a.2.b:** 63.1209(m)(1)(iv)(C) The source must inspect the data recorded by the operating parameter monitoring system at a sufficient frequency to ensure the control device is operating properly. An excursion is determined to have occurred any time that the actual value of a selected operating parameter is less than the minimum operating limit (or, if applicable, greater than the maximum operating limit) established for the parameter in accordance with the requirements of paragraph (m)(1)(iv)(A)(*3*) of this section.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.5.b.1 63.1209(n)(2)(i) *General.* The source must establish feedrate limits for semivolatile metals (cadmium and lead) and low volatile metals (arsenic, beryllium, and chromium) as follows, except as provided by paragraph (n)(2)(ii) of this section:				
1.C.5.b.1.a 63.1209(n)(2)(i)(A) The source must establish a 12-hour rolling average limit for the feedrate of cadmium and lead, combined, in all feedstreams as the average of the test run averages				
1.C.5.b.1.b 63.1209(n)(2)(i)(B) The source must establish a 12-hour rolling average limit for the feedrate of arsenic, beryllium, and chromium, combined, in all feedstreams as the average of the test run averages; and				
1.C.5.b.1.c 63.1209(n)(2)(i)(C) The source must establish a 12-hour rolling average limit for the feedrate of arsenic, beryllium, and chromium, combined, in all pumpable feedstreams as the average of the test run averages. Dual feedrate limits for both pumpable and total feedstreams are not required, however, if the source bases the total feedrate limit solely on the feedrate of pumpable feedstreams				
1.C.5.b.2 63.1209(n)(2)(ii) *Feedrate extrapolation*				
1.C.5.b.2.a 63.1209(n)(2)(ii)(A) The source may request as part of the performance test plan to use the semivolatile metal and low volatile metal feedrates and associated emission rates during the comprehensive performance test to extrapolate to higher allowable feedrate limits and emission rates. (See 1.A.11)				
1.C.5.b.2.b 63.1209(n)(2)(ii)(B) The extrapolation methodology will be reviewed and approved, as warranted, by the Administrator. The review will consider in particular whether[7]:				
1.C.5.b.2.b.1 63.1209(n)(2)(ii)(B)(*1*) Performance test metal feedrates are appropriate (i.e., whether feedrates are at least at normal levels; depending on the heterogeneity of the waste, whether some level of spiking would be appropriate; and whether the physical form and species of spiked material is appropriate); and				

[7]**Footnote to 1.C.5.b.2.b**: Under 63.1209(n)(2)(ii)(C), the Administrator will review the performance test results in making a finding of compliance required by 63.6(f)(3) and 63.1206(b)(3) to ensure that the source has interpreted emission test results properly and that the extrapolation procedure is appropriate.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.5.b.2.b.2 63.1209(n)(2)(ii)(B)(*2*) Whether the extrapolated feedrates the source has requested are warranted considering historical metal feedrate data.				
1.C.5.c 63.1209(n)(4) *Maximum total chlorine and chloride feedrate*. The source must establish a 12-hour rolling average limit for the feedrate of total chlorine and chloride in all feedstreams as the average of the test run averages.				
1.C.5.d 63.1209(n)(5) *Maximum flue gas flowrate or production rate*. As an indicator of gas residence time in the control device, the source must establish a limit on the maximum flue gas flowrate, the maximum production rate, or another parameter that the source documents in the site-specific test plan as an appropriate surrogate for gas residence time, as the average of the test run averages. The source must comply with this limit on a hourly rolling average basis. (See 1.C.1.b)				
1.C.6 63.1209(o) *Hydrochloric acid and chlorine gas*. The source must comply with the hydrogen chloride and chlorine gas emission standard by establishing and complying with the following operating parameter limits. The source must base the limits on operations during the comprehensive performance test, unless the limits are based on manufacturer specifications.				
1.C.6.a 63.1209(o)(1) *Feedrate of total chlorine and chloride.* The source must establish a 12-hour rolling average limit for the total feedrate of chlorine (organic and inorganic) in all feedstreams as the average of the test run averages.				
1.C.6.b 63.1209(o)(2) *Maximum flue gas flowrate or production rate*. As an indicator of gas residence time in the control device, the source must establish a limit on the maximum flue gas flowrate, the maximum production rate, or another parameter that it documents in the sites specific test plan as an appropriate surrogate for gas residence time, as the average of the maximum hourly rolling averages for each run. The source must comply with this limit on a hourly rolling average basis (See 1.C.1.b);				
1.C.6.c 63.1209(o)(3) *Wet scrubber.* If the combustor is equipped with a wet scrubber:				
1.C.6.c.1 63.1209(o)(3)(i) If the source is equipped with a high energy wet scrubber such as a venturi, hydrosonic, collision, or free jet wet scrubber, it must establish a limit on minimum pressure drop across the wet scrubber on an hourly rolling average as the average of the test run averages;				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.6.c.2 63.1209(o)(3)(ii) If the source is equipped with a low energy wet scrubber such as a spray tower, packed bed, or tray tower, it must establish a minimum pressure drop across the wet scrubber based on manufacturer's specifications. The source must comply with the limit on an hourly rolling average;				
1.C.6.c.3 63.1209(o)(3)(iii) If the source is equipped with a low energy wet scrubber, it must establish a limit on minimum liquid feed pressure to the wet scrubber based on manufacturer's specifications. The source must comply with the limit on an hourly rolling average;				
1.C.6.c.4 63.1209(o)(3)(iv) The source must establish a limit on minimum pH on an hourly rolling average as the average of the test run averages;				
1.C.6.c.5 63.1209(o)(3)(v) The source must establish limits on either the minimum liquid to gas ratio or the minimum scrubber water flowrate and maximum flue gas flowrate on an hourly rolling average as the average of the test run averages. If the source establishes limits on maximum flue gas flowrate under this paragraph, it need not establish a limit on maximum flue gas flowrate under paragraph (o)(2) of this section; and				
1.C.6.c.6 63.1209(o)(3)(vi) The source must establish a limit on minimum power input for ionizing wet scrubbers on an hourly rolling average as the average of the test run averages.				
1.C.6.d 63.1209(o)(4) Dry scrubber. If the combustor is equipped with a dry scrubber, the source must establish the following operating parameter limits (See 1.A.26):				
1.C.6.d.1 63.1209(o)(4)(i) *Minimum sorbent feedrate*. The source must establish a limit on minimum sorbent feedrate on an hourly rolling average as the average of the test run averages.				
1.C.6.d.2 63.1209(o)(4)(ii) *Minimum carrier fluid flowrate or nozzle pressure drop*. The source must establish a limit on minimum carrier fluid (gas or liquid) flowrate or nozzle pressure drop based on manufacturer's specifications.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.6.d.3 63.1209(o)(4)(iii) *Sorbent specifications*. The source must specify and use the brand (i.e., manufacturer) and type of sorbent used during the comprehensive performance test until a subsequent comprehensive performance test is conducted, unless it documents in the site-specific performance test plan key parameters that affect adsorption and establish limits on those parameters based on the sorbent used in the performance test[8].				
1.C.7 63.1209(p) *Maximum combustion chamber pressure.* If the source complies with the requirements for combustion system leaks under §63.1206(c)(5) by maintaining the maximum combustion chamber zone pressure lower than ambient pressure (as opposed to the other two options of either sealing the combustion chamber or obtaining approval for an alternate technique), the source must monitor the pressure instantaneously and the automatic waste feed cutoff system must be engaged when negative pressure is not maintained at any time.				
1.C.8 63.1209(q) *Operating under different modes of operation.* If the source operates under different modes of operation, it must establish operating parameter limits for each mode. The source must document in the operating record when it changes a mode of operation and begin complying with the operating parameter limits for an alternative mode of operation.				
1.C.8.a 63.1209(q)(1) *Operating under otherwise applicable standards after the hazardous waste residence time has transpired.* As provided by 63.1206(b)(1)(ii), the source may operate under otherwise applicable requirements under sections 112 and 119 of the CAA in lieu of the substantive requirements of this subpart.				
1.C.8.a.1 63.1209(q)(1)(i) The otherwise applicable requirements under sections 112 and 119 of the CAA, are applicable requirements under this subpart.				

[8]**Footnote to 1.C.6.d.3:** Under 63.1209(o)(4)(iii)(B), the source may substitute at any time a different brand or type of sorbent provided that the replacement has equivalent or improved properties compared to the sorbent used in the performance test and conforms to the key sorbent parameters the source identifies under chamber zone pressure lower than ambient pressure, the source must monitor the pressure instantaneously under paragraph (o)(4)(iii)(A) of this section. The source must record in the operating record documentation that the substitute sorbent will provide the same level of control as the original sorbent.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.8.a.2 63.1209(q)(1)(ii) The source must specify (e.g. , by reference) the otherwise applicable requirements as a mode of operation in its Documentation of Compliance under 63.1211(c), its Notification of Compliance under 63.1207(j), and its title V permit application. These requirements include the otherwise applicable requirements governing emission standards, monitoring and compliance, and notification reporting, and recordkeeping.				
1.C.8.b 63.1209(q)(2) <u>*Calculating rolling averages under different modes of operation*</u>. When the source transitions to a different mode of operation, it must calculate rolling averages as follows;				
1.C.8.b.1 63.1209(q)(2)(i) <u>*Retrieval approach.*</u> Calculate rolling averages anew using the continuous monitoring system values previously recorded for that mode of operation (i.e., you ignore continuous monitoring system values subsequently recorded under other modes of operation when you transition back to a mode of operation); or				
1.C.8.b.2 63.1209(q)(2)(ii) <u>*Start anew*</u>. Calculate rolling averages anew without considering previous recordings.				
1.C.8.b.2.a 63.1209(q)(2)(ii)(A) Rolling averages must be calculated as the average of the available one-minute values for the parameter until enough one-minute values are available to calculate hourly or 12-hour rolling averages, whichever is applicable to the parameter.				
1.C.8.b.2.b 63.1209(q)(2)(ii)(B) A source may not transition to a new mode of operation using this approach if the most recent operation in that mode resulted in an exceedance of an applicable emission standard measured with a CEMS or operating parameter limit prior to the hazardous waste residence time expiring; or				
1.C.8.b.3 63.1209(q)(2)(iii) *Seamless Transition.* Continue calculating rolling averages using data from the previous operating limit and the averaging period for the parameter are the same for both modes of operation.				
1.C.9 63.1207(g)(1)(iii) <u>*Steady-state conditions.*</u>				
1.C.9.a 63.1207(g)(1)(iii)(A) <u>*Steady-State Conditions.*</u> Prior to obtaining performance test data, the source must operate under performance test conditions until it reaches steadystate operations with respect to emissions of pollutants to be measured during the performance test and operating parameters under §63.1209 for which the source must establish limits. During system conditioning, the source must ensure that each operating parameter for which it must establish a limit is held at the level planned for the performance test. The source must include documentation in the performance test plan justifying the duration of system conditioning.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.C.9.b 63.1207(g)(1)(iii)(B) If the source owns or operates a hazardous waste cement kiln that recycles collected particulate matter (i.e., cement kiln dust) into the kiln, it must sample and analyze the recycled particulate matter prior to obtaining performance test data for levels of selected metals to be measured during performance testing to document that the system has reached steady-state conditions (i.e., that metals levels have stabilized). The source must document the rationale for selecting metals that are indicative of system equilibrium and include the information in the performance test plan under §63.1207(f). To determine system equilibrium, the source must sample and analyze the recycled particulate matter hourly for each selected metal, unless the source submits in the performance test plan a justification for reduced sampling and analysis and the Administrator approves in writing a reduced sampling and analysis frequency.				
1.D *Continuous Monitoring Systems (CMS)*				
1.D.1 63.8(c)(3) All CMS must be installed, operational, and the data verified as specified in the relevant standard either prior to or in conjunction with conducting performance tests. Verification of operational status must, at a minimum, include completion of the manufacturer's written specifications or recommendations for installation, operation, and calibration of the system				
1.D.2 63.8(e) *Performance evaluation of continuous monitoring systems*				
1.D.2.a 63.8(e)(1) and 1207(e)(1)(i) The owner or operator of an affected source being monitored must conduct a performance evaluation of the CMS. Such performance evaluation must be conducted according to the applicable specifications and procedures described in 63.8 or in the relevant standard.				
1.D.2.b 63.8(e)(2) *Notification of performance evaluation*. The owner or operator must notify the Administrator in writing of the date of the performance evaluation simultaneously with the notification of the performance test date (or at least 60 days prior to the date the performance evaluation is scheduled to begin if no performance test is required).				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
1.D.2.c 63.8(e)(3)(i) *Submission of site-specific performance evaluation test plan*. Before conducting a required CMS performance evaluation, the owner or operator of an affected source must develop and submit a site-specific performance evaluation test plan to the Administrator for approval[9]. The performance evaluation test plan must include the evaluation program objectives, an evaluation program summary, the performance evaluation schedule, data quality objectives, and both an internal and external QA program. Data quality objectives are the pre-evaluation expectations of precision, accuracy, and completeness of data.				
1.D.2.d 63.8(e)(3)(ii) The internal QA program must include, at a minimum, the activities planned by routine operators and analysts to provide an assessment of CMS performance. The external QA program shall include, at a minimum, systems audits that include the opportunity for on-site evaluation by the Administrator of instrument calibration, data validation, sample logging, and documentation of quality control data and field maintenance activities				
2. WAIVERS AND PETITIONS FOR ALTERNATE TESTING AND MONITORING				
2.A *Waiver of performance test.*				
2.A.1 63.7(h)(3)(iii) *General Performance Test Waiver* Any application for a waiver of a performance test shall include information justifying the owner's or operator's request for a waiver, such as the technical or economic infeasibility, or the impracticality, of the affected source performing the required test. (See 63.7(h) for procedures associated with granting general performance test waivers)				

[9]**Footnote to 1.D.2.c**: 63.8(e)(3)(iii) The Administrator's review and approval of the performance evaluation test plan by the Administrator will occur with the review and approval of the site-specific test plan. Under 63.8(e)(3)(iv), the Administrator may request additional relevant information after the submittal of a site-specific performance evaluation test plan.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.A.2 63.1207(m)(2) *Low Metals / Chlorine Performance Test Waiver* The source is not required to conduct performance tests to document compliance with the mercury, semivolatile metal, low volatile metal or hydrochloric acid/chlorine gas emission standards under the conditions specified below. The source is deemed to be in compliance with an emission standard if the twelve-hour rolling average MTEC determined as specified below does not exceed the emission standard:				
2.A.2.a 63.1207(m)(2)(i) Determine the feedrate of mercury, semivolatile metals, low volatile metals, or total chlorine and chloride from all feedstreams;				
2.A.2.b 63.1207(m)(2)(ii) Determine the stack gas flowrate; and				
2.A.2.c 63.1207(m)(2)(iii) Calculate a MTEC for each standard assuming all mercury, semivolatile metals, low volatile metals, or total chlorine (organic and inorganic) from all feedstreams is emitted;				
2.A.3 63.1207(m)(3) To document compliance with this provision, the source must:				
2.A.3.a 63.1207(m)(3)(i) Monitor and record the feedrate of mercury, semivolatile metals, low volatile metals, and total chlorine and chloride from all feedstreams according to §63.1209(c);				
2.A.3.b 63.1207(m)(3)(ii) Monitor with a CMS and record in the operating record the gas flowrate (either directly or by monitoring a surrogate parameter that the source has correlated to gas flowrate);				
2.A.3.c 63.1207(m)(3)(iii) Continuously calculate and record in the operating record the MTEC under the procedures of paragraph (m)(2) of this section; and				
2.A.3.d 63.1207(m)(3)(iv) Interlock the MTEC calculated in paragraph (m)(2)(iii) of this section to the AWFCO system to stop hazardous waste burning when the MTEC exceeds the emission standard.				
2.A.4 63.1207(m)(4) In lieu of the requirement in paragraph (m)(3)(iii) and (iv) of this section, the source may:				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.A.4.a 63.1207(m)(4)(i) Identify in the notification of compliance a minimum gas flowrate limit and a maximum feedrate limit of mercury, semivolatile metals, low volatile metals, and/or total chlorine and chloride from all feedstreams that ensures the MTEC as calculated in paragraph (m)(2)(iii) of this section is below the applicable emission standard; and				
2.A.4.b 63.1207(m)(4)(ii) Interlock the minimum gas flowrate limit and maximum feedrate limit in paragraph (m)(4)(i) of this section to the AWFCO system to stop hazardous waste burning when the gas flowrate or mercury, semivolatile metals, low volatile metals, and/or total chlorine and chloride feedrate exceeds the limit in paragraph (m)(4)(i).				
2.A.5 63.1207(m)(5) When the source determines the feedrate of mercury, semivolatile metals, low volatile metals, or total chlorine and chloride for purposes of this provision, except as provided by paragraph (m)(6) of this section, the source must assume that the analyte is present at the full detection limit when the feedstream analysis determines that the analyte is not detected in the feedstream.				
2.A.6 63.1207(m)(6) Owners and operators of hazardous waste burning cement kilns and lightweight aggregate kilns may assume that mercury is present in raw material at half the detection limit when the raw material feedstream analysis determines that mercury is not detected.				
2.A.7 63.1207(m)(7) The source must state in the site-specific test plan that it intends to comply with the provisions of this paragraph. The source must include in the test plan documentation that any surrogate that is proposed for gas flowrate adequately correlates with the gas flowrate.				
2.B 63.1207(c)(2) *Data in lieu of the initial comprehensive performance test*.				
2.B.1 63.1207(c)(2)(i) The source may request that previous emissions test data serve as documentation of conformance with the emission standards of this subpart provided that the previous testing :				
2.B.1.a 63.1207(c)(2)(i)(A) Was initiated after 54 months prior to the compliance date, except as provided by paragraphs (c)(2)(iii) or (c)(2)(iv) below;				
2.B.1.b 63.1207(c)(2)(i)(B) Results in data that meet quality assurance objectives (determined on a site-specific basis) such that the results demonstrate compliance with the applicable standards;				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.B.1.c 63.1207(c)(2)(i)(C) Was in conformance with the requirements of 63.1207(g)(1); and				
2.B.1.d 63.1207(c)(2)(i)(D) Was sufficient to establish the applicable operating parameter limits under §63.1209.				
2.B.2 63.1207(c)(2)(ii) The source must submit data in lieu of the initial comprehensive performance test in lieu of (i.e., if the data are in lieu of all performance testing) or with the notification of performance test required under paragraph 63.1207(e).				
2.B.3 63.1207 (c)(2)(iii) The source's date in lieu of test age restriction provided in paragraph 63.1207(c)(2)(i)(A) does not apply for the duration of the interim standards, and will not apply until EPA promulgates permanent replacement standards.				
2.B.4 63.1207(c)(2)(iv) The source's data in lieu test age restriction provided in paragraph 63.1207(c)(2)(i)(A) does not apply to DRE data provided the source does not feed hazardous waste at a location in the combustion system other than the normal flame zone.				
2.C 63.1209(a)(5) *Petitions to use CEMS for other standards*. The source may petition the Administrator to use CEMS for compliance monitoring for particulate matter, mercury, semivolatile metals, low volatile metals, and hydrochloric acid/chlorine gas under 63.8(f) in lieu of compliance with the corresponding operating parameter limits under 63.1209.				
2.D 63.1209(g) *Alternative monitoring requirements other than continuous emissions monitoring systems (CEMS).*				
2.D.1 63.1209(g)(1) *Requests to use alternative methods*.				
2.D.1.a 63.1209(g)(1)(i) The source may submit an application to the Administrator under this paragraph for approval of alternative monitoring requirements to document compliance with the emission standards of this subpart. For requests to use additional CEMS, however, the source must use 63.1209(a)(5) and 63.8(f). Under 63.1209(g)(1)(i)(A) the Administrator will not approve averaging periods for operating parameter limits longer than specified in this section unless the source documents using data or information that the longer averaging period will ensure that emissions do not exceed levels achieved during the comprehensive performance test over any increment of time equivalent to the time required to conduct three runs of the performance test[10].				

[10]**Footnote to 2.D.1.a:** Under 63.1209(g)(1)(i)(B), if the Administrator approves the application to use an alternative monitoring requirement, the source must continue to use that alternative monitoring requirement until it receives approval under this paragraph to use another monitoring requirement.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.D.1.b 63.1209(g)(1)(ii) The source may submit an application to waive an operating parameter limit specified in this section based on documentation that neither that operating parameter limit nor an alternative operating parameter limit is needed to ensure compliance with the emission standards of this subpart.				
2.D.1.c 63.1209(g)(1)(iii) The source must comply with the following procedures for applications submitted under paragraphs (g)(1)(i) and (ii) of this section:				
2.D.1.c.1 63.1209(g)(1)(iii)(A) *Timing of the application*. The source must submit the application to the Administrator not later than with the comprehensive performance test plan.				
2.D.1.c.2 63.1209(g)(1)(iii)(B) *Content of the application*. The source must include in the application:				
2.D.1.c.2.a 63.1209(g)(1)(iii)(B)(*1*) Data or information justifying the source's request for an alternative monitoring requirement (or for a waiver of an operating parameter limit), such as the technical or economic infeasibility or the impracticality of using the required approach;				
2.D.1.c.2.b 63.1209(g)(1)(iii)(B)(*2*) A description of the proposed alternative monitoring requirement, including the operating parameter to be monitored, the monitoring approach/technique (e.g., type of detector, monitoring location), the averaging period for the limit, and how the limit is to be calculated; and				
2.D.1.c.2.c 63.1209(g)(1)(iii)(B)(*3*) Data or information documenting that the alternative monitoring requirement would provide equivalent or better assurance of compliance with the relevant emission standard, or that it is the monitoring requirement that best assures compliance with the standard and that is technically and economically practicable				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.D.1.c.3 63.1209(g)(1)(iii)(C) *Approval of request to use an alternative monitoring requirement or waive an operating parameter limit*. The Administrator will notify the source of approval or intention to deny approval of the request within 90 calendar days after receipt of the original request and within 60 calendar days after receipt of any supplementary information that the source submits. The Administrator will not approve an alternative monitoring request unless the alternative monitoring requirement provides equivalent or better assurance of compliance with the relevant emission standard, or is the monitoring requirement that best assures compliance with the standard and that is technically and economically practicable[11].				
2.E 63.1206(b)(9) *Alternative standards for existing or new hazardous waste burning lightweight aggregate kilns using MACT*				
2.E.1 63.1206(b)(9)(i) The source may petition[12] the Administrator to recommend alternative semivolatile metal, low volatile metal, mercury, or hydrochloric acid/chlorine gas emission standards if:				
2.E.1.a 63.1206(b)(9)(i)(A) The source cannot achieve one or more of these standards while using maximum achievable control technology (MACT) because of the raw material contribution to emissions of the regulated metals or hydrochloric acid/chlorine gas; or				

[11]**Footnote to 2.D.1.c.3**: Before disapproving any request, the Administrator will notify the source of the Administrator's intention to disapprove the request together with: (*1*) Notice of the information and findings on which the intended disapproval is based; and (*2*) Notice of opportunity for the source to present additional information to the Administrator before final action on the request. At the time the Administrator notifies the source of intention to disapprove the request, the Administrator will specify how much time the source will have after being notified of the intended disapproval to submit the additional information. Under 63.1209(g)(1)(iii)(D), the source is responsible for ensuring that it submits any supplementary and additional information supporting the application in a timely manner to enable the Administrator to consider the application during review of the comprehensive performance test plan. Neither the source's submittal of an application, nor the Administrator's failure to approve or disapprove the application, relieves the source of the responsibility to comply with the provisions of this subpart.

[12]**Footnote to 2.E.1**: Under 63.1206(b)(9)(vii), the source must not operate pursuant to its recommended alternative standards in lieu of emission standards specified in 63.1205(a) and (b) unless the Administrator approves the provisions of the alternative standard petition request or establishes other alternative standards; and until the source submits a revised Notification of Compliance that incorporates the revised standards.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.E.1.b 63.1206(b)(9)(i)(B) The source determine that mercury is not present at detectable levels in the raw material.				
2.E.2 63.1206(b)(9)(ii) The alternative standard that the source recommends under paragraph (b)(9)(i)(A) of this section may be an operating requirement, such as a hazardous waste feedrate limitation for metals and/or chlorine, and/or an emission limitation.				
2.E.3 63.1206(b)(9)(iii) The alternative standard must include a requirement to use MACT, or better, applicable to the standard for which the source is seeking relief, as defined in paragraphs (b)(9)(viii) and (ix) of this section.				
2.E.4 63.1206(b)(9)(iv) *Documentation required.*				
2.E.4.a 63.1206(b)(9)(iv)(A) The alternative standard petition the source submits under 63.1206(b)(9)(i)(A) must include data or information documenting that raw material contributions to emissions of the regulated metals or hydrochloric acid/chlorine gas prevent the source from complying with the emission standard even though it is using MACT, as defined in 63.1206(b)(9)(viii) and (ix), for the standard for which the source is seeking relief.				
2.E.4.b 63.1206(b)(9)(iv)(B) Alternative standard petitions that the source submits under 63.1206(b)(9)(i)(B) must include data or information documenting that mercury is not present at detectable levels in raw materials.				
2.E.5 63.1206(b)(9)(v) The source must include data or information with semivolatile metal and low volatility metal alternative standard petitions that the source submits under 63.1206(b)(9)(i)(A) documenting that increased chlorine feedrates associated with the burning of hazardous waste, when compared to non-hazardous waste operations, do not significantly increase metal emissions attributable to raw materials.				
2.E.6 63.1206(b)(9)(vi) The source must include data or information with semivolatile metal, low volatile metal, and hydrochloric acid/chlorine gas alternative standard petitions that the source submits under 63.1206(b)(9)(i)(A) documenting that semivolatile metal, low volatile metal, and hydrochloric acid/chlorine gas emissions attributable to the hazardous waste only will not exceed the emission standards in 63.1205(a) and (b).				
2.E.7 63.1206(b)(9)(viii) For purposes of this alternative standard provision, MACT for existing hazardous waste burning lightweight aggregate kilns is defined as:				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.E.7.a 63.1206(b)(9)(viii)(A) For mercury, a hazardous waste feedrate corresponding to an MTEC of 24 Fg/dscm or less;				
2.E.7.b 63.1206(b)(9)(viii)(B) For semivolatile metals, a hazardous waste feedrate corresponding to an MTEC of 280,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 57 mg/dscm or less				
2.E.7.c 63.1206(b)(9)(viii)(C) For low volatile metals, a hazardous waste feedrate corresponding to an MTEC of 120,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 57 mg/dscm or less; and				
2.E.7.d 63.1206(b)(9)(viii)(D) For hydrochloric acid/chlorine gas, a hazardous waste chlorine feedrate corresponding to an MTEC of 2,000,000 Fg/dscm or less, and use of an air pollution control device with a hydrochloric acid/chlorine gas removal efficiency of 85 percent or greater.				
2.E.8 63.1206(b)(9)(ix) For purposes of this alternative standard provision, MACT for new hazardous waste burning lightweight aggregate kilns is defined as:				
2.E.8.a 63.1206(b)(9)(ix)(A) For mercury, a hazardous waste feedrate corresponding to an MTEC of 4 Fg/dscm or less;				
2.E.8.b 63.1206(b)(9)(ix)(B) For semivolatile metals, a hazardous waste feedrate corresponding to an MTEC of 280,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 57 mg/dscm or less;				
2.E.8.c 63.1206(b)(9)(ix)(C) For low volatile metals, a hazardous waste feedrate corresponding to an MTEC of 46,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 57 mg/dscm or less;				
2.E.8.d 63.1206(b)(9)(ix)(D) For hydrochloric acid/chlorine gas, a hazardous waste chlorine feedrate corresponding to an MTEC of 14,000,000 Fg/dscm or less, and use of a wet scrubber with a hydrochloric acid/chlorine gas removal efficiency of 99.6 percent or greater.				
2.F 63.1206(b)(10) *Alternative standards for existing or new hazardous waste burning cement kilns using MACT*				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.F.1 63.1206(b)(10)(i) The source may petition[13] the Administrator to recommend alternative semivolatile, low volatile metal, mercury, and/or hydrochloric acid/chlorine gas emission standards if:				
2.F.1.a 63.1206(b)(10)(i)(A) The source cannot achieve one or more of these standards while using maximum achievable control technology (MACT) because of raw material contributions to emissions of the regulated metals or hydrochloric acid/chlorine gas; or				
2.F.1.b 63.1206(b)(10)(i)(B) The source determines that mercury is not present at detectable levels in its raw material.				
2.F.2 63.1206(b)(10)(ii) The alternative standard that the source recommends under paragraph 63.1206(b)(10)(i)(A) may be an operating requirement, such as a hazardous waste feedrate limitation for metals and/or chlorine, and/or an emission limitation				
2.F.3 63.1206(b)(10)(iii) The alternative standard must include a requirement to use MACT, or better, applicable to the standard for which the source is seeking relief, as defined in paragraphs 63.1206(b)(10)(viii) and (ix).				
2.F.4 63.1206(b)(10)(iv) <u>*Documentation required*</u>				
2.F.4.a 63.1206(b)(10)(iv)(A) The alternative standard petition the source submits under paragraph 63.1206(b)(10)(i)(A) must include data or information documenting that raw material contributions to emissions prevent the source from complying with the emission standard even though it is using MACT, as defined in paragraphs 63.1206(b)(10)(viii) and (ix), for the standard for which it is seeking relief.				
2.F.4.b 63.1206(b)(10)(iv)(B) Alternative standard petitions that the source submits under paragraph 63.1206(b)(10)(i)(B) must include data or information documenting that mercury is not present at detectable levels in raw materials.				

[13]**Footnote to 2.F.1** 63.1206(b)(10)(vii) The source must not operate pursuant to its recommended alternative standards in lieu of emission standards specified in 63.1204(a) and (b) unless the Administrator approves the provisions of the alternative standard petition request or establishes other alternative standards; and until the source submits a revised Notification of Compliance that incorporates the revised standards.

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.F.5 63.1206(b)(10)(v) The source must include data or information with semivolatile metal and low volatile metal alternative standard petitions that the source submits under paragraph 63.1206(b)(10)(i)(A) documenting that increased chlorine feedrates associated with the burning of hazardous waste, when compared to non-hazardous waste operations, do not significantly increase metal emissions attributable to raw materials.				
2.F.6 63.1206(b)(10)(vi) The source must include data or information with semivolatile metal, low volatile metal, and hydrochloric acid/chlorine gas alternative standard petitions that the source submits under paragraph (b)(10)(i)(A) of this section documenting that emissions of the regulated metals and hydrochloric acid/chlorine gas attributable to the hazardous waste only will not exceed the emission standards in 63.1204(a) and (b).				
2.F.7 63.1206(b)(10)(viii) For purposes of this alternative standard provision, MACT for existing hazardous waste burning cement kilns is defined as:				
2.F.7.a 63.1206(b)(10)(viii)(A) For mercury, a hazardous waste feedrate corresponding to an MTEC of 88 Fg/dscm or less;				
2.F.7.b 63.1206(b)(10)(viii)(B) For semivolatile metals, a hazardous waste feedrate corresponding to an MTEC of 31,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 0.15 kg/Mg dry feed or less;				
2.F.7.c 63.1206(b)(10)(viii)(C) For low volatile metals, a hazardous waste feedrate corresponding to an MTEC of 54,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 0.15 kg/Mg dry feed or less; and				
2.F.7.d 63.1206(b)(10)(viii)(D) For hydrochloric acid/chlorine gas, a hazardous waste chlorine feedrate corresponding to an MTEC of 720,000 Fg/dscm or less.				
2.F.8 63.1206(b)(10)(ix) For purposes of this alternative standard provision, MACT for new hazardous waste burning cement kilns is defined as:				
2.F.8.a 63.1206(b)(10)(ix)(A) For mercury, a hazardous waste feedrate corresponding to an MTEC of 7 Fg/dscm or less;				
2.F.8.b 63.1206(b)(10)(ix)(B) For semivolatile metals, a hazardous waste feedrate corresponding to an MTEC of 31,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 0.15 kg/Mg dry feed or less;				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.F.8.c 63.1206(b)(10)(ix)(C) For low volatile metals, a hazardous waste feedrate corresponding to an MTEC of 15,000 Fg/dscm or less, and use of a particulate matter control device that achieves particulate matter emissions of 0.15 kg/Mg dry feed or less;				
2.F.8.d 63.1206(b)(10)(ix)(D) For hydrochloric acid/chlorine gas, a hazardous waste chlorine feedrate corresponding to an MTEC of 420,000 Fg/dscm or less.				
2.G 63.1206(b)(14) *Alternative to the particulate matter standard for incinerators*.				
2.G.1 63.1206(b)(14)(i) *General.* In lieu of complying with the applicable particulate matter standard of 63.1203(a)(7) or (b)(7), existing and new incinerators may elect to instead comply with the alternative metal emission control requirements described in paragraph 63.1206(b)(14)(ii) or (b)(14)(iii), both of which set the particulate matter emission limit of 34 mg/dscm corrected to 7 percent oxygen. .				
2.G.2 63.1206(b)(14)(ii) *Alternative metal emission control requirements for existing incinerators*.				
2.G.2.a 63.1206(b)(14)(ii)(A) The source must not discharge or cause combustion gases to be emitted into the atmosphere that contain lead, cadmium, and selenium in excess of 240 ug/dscm, combined emissions, corrected t 7 percent oxygen; and,				
2.G.2.b 63.1206(b)(14)(ii)(B) The source must not discharge or cause combustion gases to be emitted into the atmosphere that contain arsenic, beryllium, chromium, antimony, cobalt, manganese, and nickel in excess of 97 ug/dscm, combined emissions; and,				
2.G.2.c 63.1206(b)(14)(ii)(C) The source must comply with the provisions specified in 63.1206(b)(14)(iv) below.				
2.G.3 63.1206(b)(14)(iii) *Alternative metal emission control requirements for new incinerators*.				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.G.3.a 63.1206(b)(14)(iii)(A) The source must not discharge or cause combustion gases to be emitted into the atmosphere that contain lead, cadmium, and selenium in excess of 24 ug/dscm, combined emissions, corrected to 7 percent oxygen; and,				
2.G.3.b 63.1206(b)(14)(iii)(B) The source must not discharge or cause combustion gases to be emitted into the atmosphere that contain arsenic, beryllium, chromium, antimony, cobalt, manganese, and nickel in excess of 97 ug/dscm, combined emissions, corrected to 7 percent oxygen; and,				
2.G.3.c 63.1206(b)(14)(iii)(C) The source must comply with 63.1206(b)(14)(iv) below.				
2.G.4 63.1206(b)(14)(iv) <u>*Other Requirements*</u>. Existing and new incinerators must document in the operating record that they meet the requirements of paragraph (b)(14)(iv)(A)-(C), listed immediately below.				
2.G.4.a 63.1206(b)(14)(iv)(A) The twelve-hour rolling average of the maximum theoretical emissions concentration for lead, cadmium, and selenium, combined, for the combined hazardous waste feedstreams to the incinerator, must not exceed: (1) 1,325 ug/dscm for existing incinerators; and (2) 875 ug/dscm for new incinerators.				
2.G.4.b 63.1206(b)(14)(iv)(B) The twelve-hour rolling average of the maximum theoretical emissions concentration for arsenic, beryllium, chromium, antimony, cobalt, manganese, and nickel, combined, for the combined hazardous waste feedstreams to the incinerator, must not exceed: (1) 6,000 ug/dscm for existing incinerators; and (2) 3,250 ug/dscm for new incinerators.				
2.G.4.c 63.1206(b)(14)(iv)(C) The source must document that its air pollution control system achieves at least a 90 percent system removal efficiency for semivolatile metals. To make this determination, the source may spike semivolatile metals above the applicable levels set forth in paragraphs 63.1206(b)(14)(iv)(A) or (B) provided that the applicable alternative emission limitation of paragraphs 63.1206(b)(14)(ii)(A) or (iii)(A) is attained during the test. This test may be performed independently of the comprehensive performance test and must be used to establish applicable operating parameter limits as described in 63.1209(n), not including 63.1209(n)(2), to ensure that a 90 percent semivolatile metal system removal efficiency is achieved during normal operations.				
2.G.5 63.1206(b)(15) <u>*Alternative to the interim standards for mercury for cement and lightweight aggregate kilns.*</u>				
2.G.5.a 63.1206(b)(15)(i) <u>*General*</u> *In Lieu of complying with the applicable mercury standards of 63.1204(a)(2) and (b)(2) for existing and new cement kilns and 63.1205(a)(2) and (b)(2) for existing and new lightweight aggregate kilns, the source may instead elect to comply with the alternative mercury standard described in 63.1206(b)(15)(ii)-(v), listed below:*				
2.G.5.b 63.1206(b)(15)(ii) <u>*Operating Requirements*</u> The source must not exceed a hazardous waste feedrate corresponding to a maximum theoretical emission concentration (MTEC) of 120 ug/dscm on a twelve-hour rolling average.				
2.G.5.c 63.1206(b)(15)(iii) To document compliance with the operating requirement of paragraph 63.1206(b)(15)(ii), the source must:				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.G.5.c.1 63.1206(b)(15)(iii)(A) Monitor and record the feedrate of mercury for each hazardous waste feedstream according to 63.1209(c);				
2.G.5.c.2 63.1206(b)(15)(iii)(B) Monitor with a CMS and record n the operating record the gas flowrate (either directly or by monitoring a surrogate parameter that you have correlated to gas flowrate);				
2.G.5.c.3 63.1206(b)(15)(iii)(C) Continuously calculate and record in the operating record a MTEC assuming mercury from all hazardous waste feedstreams is emitted;				
2.G.5.c.4 63.1206(b)(15)(iii)(D) Interlock the MTEC calculated under 63.1206(b)(15)(iii)(C) to the AWFCO system to stop hazardous waste burning when the MTEC exceeds the operating requirement of 63.1206(b)(15)(ii).				
2.G.5.d 63.1206(b)(15)(iv) In lieu of the requirements of 63.1206(b)(15)(iii), the source may:				
2.G.5.d.1 63.1206(b)(15)(iv)(A) Identify in the Notification of Compliance a minimum gas flowrate limit and a maximum feedrate limit f mercury from all hazardous waste feedstreams that ensures the MTEC calculated in paragraph 63.1206(b)(15)(iii)(C) is below the operating requirement of 63.1206(b)(15)(ii); and				
2.G.5.d.2 63.1206(b)(15)(iv)(B) Interlock the minimum gas flowrate limit and maximum feedrate limits in 63.1206(b)(15)(iv)(A) to the AWFCO system to stop hazardous waste burning when the gas flowrate or mercury feedrate exceeds the limits in 63.1206(b)(15)(iv)(A).				
2.G.5.e 63.1206(b)(15)(v) *Notification Requirement* The source must notify in writing the RCRA authority if it intends to comply with the alternative standard.				
2.H 63.7(f) *Use of an alternative test method*				

U.S. EPA Checklist for Review of Phase 1 HWC MACT Comprehensive Performance Test Plan – May 28, 2002				
Requirement	**Addressed Yes/No/NA**	**Location in Test Plan**	**Adequate Y/N**	**Comments**
2.H.1 63.7(f)(2) The owner or operator of an affected source required to do performance testing by a relevant standard may[14] use an alternative test method from that specified in the standard provided that the owner or operator:				
2.H.1.a 63.7(f)(2)(i) Notifies the Administrator of his or her intention to use an alternative test method at least 60 days before the performance test is to begin.				
2.H.1.b 63.7(f)(2)(ii) Uses Method 301 in Appendix A of Part 63 to validate the alternative test method. This may include the use of specific procedures of Method 301 if use of such procedures are sufficient to validate the alternative test method and;				
2.H.1.c 63.7(f)(2)(iii) Submits the results of the Method 301 validation process along with the notification of intention and the justification for not using the specified test method. The owner or operator may submit the information required in this paragraph well in advance of the deadline specified in paragraph (f)(2)(i) of this section to ensure a timely review by the Administrator in order to meet the performance test date specified in this section or the Relevant standard.				

Other Useful References for Developing or Reviewing a Comprehensive Performance Test Plan:

Because CPT Plan requirements are generally similar to those for RCRA hazardous waste incinerator trial burns and BIF Certification of Compliance testing, guidance for those tests might be useful in developing or reviewing the CPT Plan. Important guidance on those RCRA tests can be found in:

• U.S. EPA, "Hazardous Waste Combustion Unit Permitting Manual, Component 1, How to Review a Trial Burn Plan," Center for Combustion Science and Engineering, Multi Media Planning and Permitting Division, EPA Region 6, December 1997.

• U.S. EPA, "Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations," EPA/530/R-92/011, PB 92-154947, March 1992.

• U.S. EPA, "Handbook: Guidance on Setting Permit Conditions and Reporting Trial Burn Results, Volume II of the Hazardous Waste Incineration Guidance Series," EPA/625/6-89/019, January 1989.

[14]**Footnote to 2.H.1**: Under 63.7(f)(3) and (4), the Administrator will determine whether the owner or operator's validation of the proposed alternative test method is adequate and issue an approval or disapproval of the alternative test method. If the source intends to demonstrate compliance by using an alternative to any test method specified in the relevant standard, the source is authorized to conduct the performance test using an alternative test method after the Administrator approves the use of the alternative method. However, the source is authorized to conduct the performance test using an alternative method in the absence of notification of approval/disapproval 45 days after submission of the request to use an alternative test method and the request satisfies the requirements in 63.7(f)(2). The source or operator is authorized to conduct the performance test within 60 calendar days after he/she is authorized to demonstrate compliance using an alternative test method. Notwithstanding the requirements in the preceding three sentences, the source may proceed to conduct the performance test as required in this section (without the Administrator's prior approval of the site-specific test plan) if he/she subsequently chooses to use the specified testing and monitoring methods instead of an alternative. See 67 FR 16603. If the Administrator finds reasonable grounds to dispute the results obtained by an alternative test method for the purposes of demonstrating compliance with a relevant standard, the Administrator may require the use of a test method specified in a relevant standard. Until permission to use an alternative test method has been granted by the Administrator under 63.7(f), the owner or operator of an affected source remains subject to the requirements of this section and the relevant standard.

Technical Support Document for HWC MACT Standards

Volume IV:
Compliance with the HWC MACT Standards

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response (5305)
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

September 2005

Acknowledgments

This document was prepared by U.S. EPA's Office of Solid Waste, Hazardous Waste Minimization and Management Division. EERGC Corporation provided technical support under Contract 68-W-01-024.

Contents

Tables

Figures

Acronyms and Abbreviations

ACA	absolute calibration audit
APCD	air pollution control device
APCS	air pollution control system
ASME	American Society of Mechnical Engineering
ASTM	American Society of Testing and Materials
AWFCO	automatic waste feed cutoff
BET	Brunauer-Teller-Emmett
BIF	boilers and industrial furnaces
BLDS	bag leak detector system
CAA	Clean Air Act
CAAA	1990 Clean Air Act Amendments
CAM	compliance assurance monitoring
CD	calibration drift
CE	calibration error
CEMS	continuous emissions monitoring system
CFR	Code of Federal Regulations
CGA	cylinder gas audit
CK	cement kiln
Cl_2	chlorine, in its diatomic form
CMS	continuous monitoring system
CO	carbon monoxide
CoC	certification of compliance
COM	continuous opacity monitor
DL	detection limit
DOC	documentation of compliance
DRE	destruction and removal efficiency
dscf	dry standard cubic foot
dscm	dry standard cubic meter
EPA	U.S. Environmental Protection Agency
ESP	electrostatic precipitator
ESV	emergency safety vent
FAP	feedstream analysis plan
FF	fabric filter
GCP	good combustion practice
GFC	gas filter correlation
gr	grain
HAP	hazardous air pollutant
HCl	hydrogen chloride
HC	hydrocarbons
HEPA	high energy particulate air
Hg	mercury
HRA	hourly rolling average

HWC	hazardous waste combustor
HWI	hazardous waste incinerator
IWS	ionizing wet scrubber
kg	kilogram
kV	kilovolts
kVA	kilovolt-amperes
lb	pound
LVM	low volatile metals
LWAK	lightweight aggregate kiln
MACT	maximum achievable control technology
mg	milligram
Mg	megagram
MTEC	maximum theoretical emissions concentration
MWC	municipal waste combustor
MWI	medical waste incinerator
ng	nanogram
NIC	Notice of Intent to Comply
NIST	National Institute of Standards and Technology
NOC	Notification of Compliance
NO_x	oxides of nitrogen
O&M	operating and maintenance
OPL	operating parameter limit
O_2	diatomic oxygen
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
pH	a measure of acidity (the negative logarithm (base 10) of the hydronium ion concentration)
PIC	product of incomplete combustion
POHC	principal organic hazardous constituent
PM	particulate matter
ppmw	parts per million by weight
ppmv	parts per million by volume
PS	performance specification
QA	quality assurance
QC	quality control
RA	rolling average, relative accuracy
RATA	relative accuracy test audit
RCA	response correlation audit
RCRA	Resource Conservation and Recovery Act
SVM	semivolatile metals
SVOC	semivolatile organic compound
SO_2	sulfur dioxide

SRE	system removal efficiency
TDL	target detection limit
TEQ	toxic equivalent
TSCA	Toxic Substances Control Act
ug	microgram
VOC	volatile organic compound
VOST	volatile organic sampling train
WAP	waste analysis plan
WESP	wet electrostatic precipitator
ZD	zero drift

1.0 Introduction

The United States Environmental Protection Agency (EPA) is promulgating "Maximum Achievable Control Technology" (MACT) standards for "hazardous air pollutants" (HAPs) for hazardous waste combustors: hazardous waste burning incinerators, cement kilns, lightweight aggregate kilns, boilers, and hydrochloric acid production furnaces. The MACT standards for the "Phase I" hazardous waste burning incinerators, cement kilns, and lightweight aggregate kilns replace the interim standards promulgated for these sources on February 13 and 14, 2002 (67 FR 6792 and 67 FR 6968). The MACT standards for "Phase II" hazardous waste burning categories – boilers and hydrochloric acid production furnaces – are being promulgated on the same schedule as the replacement Phase I standards.

This document provides technical background for compliance with the proposed HWC MACT rule. It includes the following Sections:

Section 2 – Operating parameter limit general issues
Section 3 – PCDD/PCDF operating limits
Section 4 – PM operating limits
Section 5 – Mercury operating limits
Section 6 – Semivolatile and low volatile metals operating limits
Section 7 – Total chlorine operating limits
Section 8 – Non-PCDD/PCDF organics operating limits
Section 9 – Destruction and removal efficiency operating limits
Section 10 – Combustion system leak operating limits
Section 11 – Automatic waste feed cutoff requirements
Section 12 – Continuous monitoring systems
Section 13 – Continuous emissions monitoring systems
Section 14 – Performance testing
Section 15 – Test methods
Section 16 – Startup, shutdown, and malfunction plan
Section 17 – Emergency safety vents
Section 18 – Operator certification and training
Section 19 – Operating and maintenance plan
Section 20 – Feedstream analysis plan
Section 21 – Initial notifications
Section 22 – Notification of Compliance
Section 23 – Special provisions

2.0 Operating Parameter General Issues

2.1 Applicability of Operating Limits

Compliance with the HWC MACT emissions standards through CEMS and surrogate operating parameter limits (as contained in the DOC or NOC) is required at all times except: (1) when operating under the startup, shutdown, and malfunction plan; and (2) if hazardous waste does not remain in the combustion system, when you comply with otherwise applicable MACT standards. Determination of the residence time that waste remains in the combustion system must be contained in the Agency-reviewed and approved comprehensive performance test plan.

2.1.1 Temporarily Cease Burning Hazardous Waste

HWC sources that temporarily cease burning hazardous waste for any reason remain subject to the HWC MACT requirements until they are no longer an affected source. However, HWC sources do not have to comply with the HWC MACT emission standards (through CEMS or operating limits) when hazardous waste is not being fed and does not remain in the combustion chamber, and either:

- The source is in compliance with other applicable MACT standards.

  -- Cement kilns – Portland Cement Manufacturing Industry MACT rule -- see 40 CFR Part 63 Subpart LLL.

  -- Incinerators – Industrial Waste Incinerator MACT rule.

  -- Liquid fuel and solid fuel boilers – Industrial boiler MACT rule, 40 CFR Part 63, Subpart DDDDD.

  -- HCl Production furnaces – HCl production furnace MACT rule.

- The source is in a startup, shutdown, or malfunction mode of operation, and documented to be operated under the Startup, Shutdown, and Malfunction Plan requirements.

Requirements under these alternative compliance options when not burning hazardous waste include:

- Complying with all of the applicable notification requirements of the alternative regulation.

- Complying with all the monitoring, recordkeeping, and testing requirements of the alternative regulation.

- Including in the Notice Of Compliance (or Documentation of Compliance) the alternative mode(s) of operation.

- Noting in the operating record the beginning and end of each period when complying with the alternative regulation.

If a source operates under these alternative provisions for longer than 3 months (i.e., and not burning hazardous waste for longer than 3 months), then the source must initiate closure pursuant to RCRA requirements (as discussed in the next section for sources which plan to permanently stop burning hazardous wastes). An extension of the date to begin RCRA closure may be requested of the Agency.

Procedures to comply with the operating limits when shifting between modes of operation are discussed in detail in Section 23.13.

2.1.2 Permanently Stop Burning Hazardous Waste

The Agency must be notified immediately when a source permanently ceases to burn hazardous waste. RCRA rules then require that closure procedures be initiated within 3 months of the last acceptance of hazardous waste. An extension may be requested from the Agency. Compliance with other applicable MACT standards and regulations, if there are any, including notifications, monitoring, and performance test requirements.

2.2 Rationale for Averaging Periods Selected for Operating Parameter Limits

Sources must demonstrate compliance with the standards by conducting a comprehensive performance test. This test averages three runs (consistent with the data underlying the standards) to determine compliance. Results of the comprehensive performance test are used to establish operating parameter limits which reasonably assure that emissions will not exceed those demonstrated in the performance test for the duration of the comprehensive performance test and for any given period corresponding to that duration thereafter. Thus, averaging periods for operating parameter limits are selected to reasonably assure compliance with the emissions standards for the duration equivalent to three runs of the performance test. Four different averaging periods are used, depending on the relation between the operating parameter limit and the emissions level:

- Instantaneous

- 12-hour rolling average

- Hourly (1-hour) rolling average
- Annual rolling average

2.2.1 Instantaneous

An instantaneous limit is required only for combustion chamber pressure (combustion chamber pressure may be selected to control combustion system leaks). An instantaneous limit is used because any perturbation above the limit may result in uncontrolled emissions exceeding the MACT standards.

2.2.2 12-hour Average

A 12-hour averaging period is used for those parameters which are generally linearly related to emissions. These include feedrate limits for metals, chlorine, and ash; and solids content of the scrubber liquid water when monitored with a continuous monitoring system because particulate matter emissions are expected to be linearly related to the solids concentration in the scrubber water.

A 12-hour averaging period has been chosen because it is the upper bound of the combined duration of a typical comprehensive performance emissions test. Tables 2-1 and 2-2 show sample times used for metals and chlorine trains for trial burns and compliance tests taken from the HWC Emissions Data Base.

Table 2-1. Examples of Chlorine and Metal Sampling Train Durations for Incinerators

Condition	Chlorine		Metals	
	Sample Time (hr)	Sample Vol. (dscf)	Sample Time (hr)	Sample Vol. (dscf)
331C2	1	44		
331C3	1	44		
713C1	1	35		
808C1	2	75		
808C2	2	70		
357C1	3.5	100		
477C1	3	81		
700C1	2	71		
700C2	2	71		
806C1	1.5	45		
500C1	3	88		
500C2	2	60		
500C3	3	88		
504C1	1	42	2	84
347C1	1.3	36	2.7	74
340C1	2	81	2	81
340C2	2	82	2	82
459C1	1	32		
454C1	1.7	81		
605C1	1	30	1	30
209C1	2	81	2	85
209C2	2	70	2	69

Table 2-2. Examples of Chlorine and Metal Sampling Train Durations for Cement and Lightweight Aggregate Kilns

Condition	Chlorine		Metals	
	Sample Time (hr)	Sample Vol. (dscf)	Sample Time (hr)	Sample Vol. (dscf)
318C1	2	68	2	70
309C1	1	50	2	92
320C1	2	60	4	111
321C1	7	200	7.2	221
335C6	2	84	2	83
203C4	1.4	65	1.4	65
203C5	1	32	2	65
203C6	1	47		
200C4	2	77	2	71
200C5	2	76	2	70
200C6	2	67	2	59
204C1			2	75
302C1	4	85	4	80
302C4	3.5	87	3.5	95
304C1			2	45
308C1	1.5	45		
481C1	2	76	2	94
315C1	2	99	2	100
315C2	2	98	2	97
303C1	2	66	2	68
608C1	2	94	1	45
680C1	2	63	1.8	59
225C1	2	100	1	51
223C1	2	70	1	34
226C1	2	86	1	43
224C1	2	80	2	80

2.2.3 One-hour Average

For other operating parameters which are not linearly related to emissions, a shorter averaging period better assures compliance with the emission standards. A shorter averaging period is appropriate for the operating parameters because:

- When there is a nonlinear relationship between HAP emissions and the limited operating parameter, short term excursions of the operating parameter may result in emissions spikes which are not balanced out by proportionally lower emissions when the operating parameter returns to levels which will result in compliance on a long-term average basis.

- The operating parameter is indicative of rapid, unrecoverable deterioration of the process effectiveness, so that quick control response is required to assure compliance with the emissions standards.

As discussed below, all of the operating parameters are easily controllable within a one-hour time frame, and this period will, in most instances, provide adequate assurance that emissions will not exceed those demonstrated in the comprehensive performance test.

The operating parameters that are required to be averaged on a one-hour basis can be classified into five groups based on their general relationship to HAP emissions:

- Group 1:
  - -- Group 1A
    - .. Minimum carbon feedrate to a carbon injection system
    - .. Minimum inhibitor feedrate to a dioxin/furan inhibitor injection system
    - .. Minimum sorbent feedrate to a dry scrubber
    - .. Minimum pressure drop across a high energy scrubber
    - .. Minimum scrubber liquid flowrate and maximum flue gas flowrate, or minimum scrubber liquid/gas ratio
  - -- Group 1B
    - .. Minimum carrier fluid flowrate or nozzle pressure drop
    - .. Minimum pressure drop across a low energy scrubber
    - .. Minimum liquid feed pressure to low energy wet scrubber
- Group 2
  - -- Maximum temperature at the inlet to a dry particulate matter control device (Maximum temperature exiting the kiln for lightweight aggregate kilns)
- Group 3
  - -- Minimum gas temperature at inlet to a catalytic oxidizer
  - -- Minimum gas temperature for each combustion chamber
  - -- Maximum gas temperature at inlet or exit of carbon bed
  - -- Minimum pH of scrubber liquid
- Group 4
  - -- Maximum catalytic oxidizer temperature
- Group 5
  - -- Maximum hazardous waste feedrate
  - -- Maximum flue gas flowrate (or surrogate)

Note that hazardous waste firing system parameters, for which limits are identified and established on a site-specific basis, typically fall into Groups 1 or 3.

The general relationship between the Group 1 operating parameters and corresponding HAP emissions levels (and HAP control efficiency) is shown in Figure 2-1. At one extreme of operation, the device is effectively not being used (the operating parameter reads "zero"), and no control is being achieved -- for example, no sorbent is injected, ESP has no input power, etc.

Emissions would be at an "uncontrolled" level. As the device begins to function, the operating parameter increases and HAP emissions are reduced at a fairly rapid rate. However, as the parameter continues to "improve", corresponding HAP emissions reductions decrease at a much slower rate and approach some limiting maximum degree of control (corresponding to a minimum achievable HAP emissions level). The relationship between these operating parameters and HAP emissions is clearly not linear (although it may approach linearity over a small range of operating parameter levels, for example at the lower or higher ends of the curve).

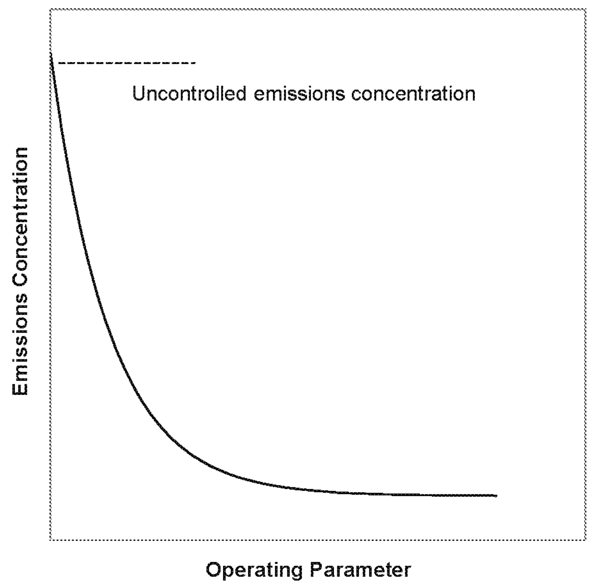


Figure 2-1. Typical relationship between Group 1 operating parameter and emission concentrations of controlled HAP

Group 1 parameters are further subdivided into Group 1A and Group 1B. Limits for Group 1A parameters are set from the comprehensive performance test. For example, consider the case illustrated in Figure 2-2 where during the performance test, sorbent is fed at a steady stoichiometric ratio of 3, with a chlorine system removal efficiency (SRE) of 90%. During subsequent operations, sorbent is fed at a stoichiometric ratio of 2 (with SRE of 70%) and 4 (with SRE of 93%) during equal 6-hour periods, with a resulting average SR of 3. The average SRE during this 12-hour period is 81.5% which is much lower than that during the performance testing. Resulting emissions would be almost twice as high as that during the performance testing, assuming a similar uncontrolled chlorine loading to the dry scrubber. One-hour averages would better assure that a source does not cycle its sorbent feedrate above and below the average levels demonstrated in the performance test such that chlorine emissions during normal operations would be higher than those demonstrated during the performance test.

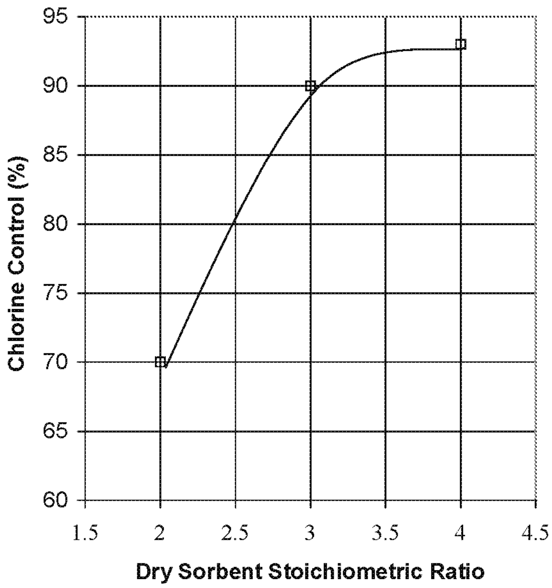


Figure 2-2. Chlorine control as a function of dry sorbet stoichiometric ratio.

Pressure drop across a high-energy wet scrubber provides another example of a Group 1A parameter. The typical nonlinear relationship between venturi scrubber pressure drop and scrubber performance efficiency for particulate matter is shown in Figure 2-3. Particulate matter capture efficiency is known to be exponentially related to pressure drop for a given particle size. Consider a case where, during the performance test, a particulate matter level of 0.03 gr/dscf is achieved at a pressure drop of 37 inches H_2O (based on an uncontrolled inlet of 0.3 gr/dscf, and a scrubber capture performance of 90%). During subsequent operations, however, the source cycles at pressure drops of 30 in. water (removal efficiency of 83%) and 45 in. water (removal efficiency 94%) during equal 6-hour time periods to maintain compliance on a 12-hour basis. The resulting average particulate matter emissions over this time period is 0.035 gr/dscf, which is about 20% higher than that during the performance testing. One-hour averages would better assure that a source does not cycle its pressure drop above and below the average levels demonstrated in the performance test such that emissions during normal operations would be higher than those demonstrated during the performance test.

Limits for Group 1B parameters are set based on manufacturer specifications. They are not set from the performance test because:

- Emissions are not typically very sensitive to the values of these parameters within the normal operating range;

- It is difficult to control these parameters sufficiently to allow maximizing/minimizing them in a comprehensive performance test; and/or
- They may conflict with other, more important parameters making it difficult to simultaneously maximize/minimize all parameters in the same comprehensive performance test.

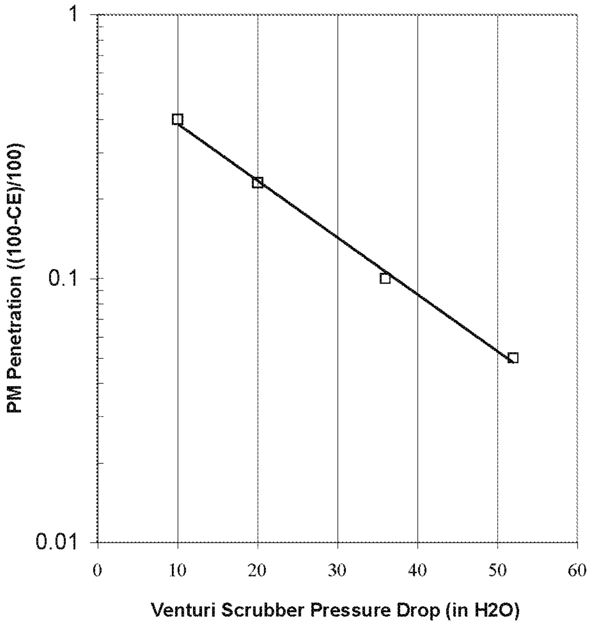


Figure 2-3. Venturi scrubber performance as a function of scrubber pressure drop.

The Group 2 parameter, dry APCD temperature, is a nonlinear indicator for PCDD/PCDF control. Much testing has shown that PCDD/PCDF emission rate increases exponentially by roughly an order of magnitude for every 150°F increase in APCD temperature (see section 3.2). Consider an example facility which takes extraordinary measures to operate a rock-steady performance test. The APCD temperature for the entire performance test is constant and the dioxin emissions in the performance test are exactly at the standard. In normal operation with a single 12-hour rolling average limit, the facility could conceivably cycle its instantaneous APCD temperature to equal extremes above and below the 12-hour rolling average limit for 6 hours at a time and still comply with the 12-hour rolling average limit. Because of the nonlinear nature of the relationship between APCD temperature and PCDD/PCDF emissions, the higher emissions at the high temperature extreme are not entirely offset by lower emissions at the lower temperature extreme. If, as has been documented, PCDD/PCDF emissions for this facility increase an order of magnitude for every 150°F, emissions at 25°F above the 12-hour rolling average limit would result in dioxin emissions 47% above the standard and emissions at 25°F below the 12-hour rolling average limit would result in PCDD/PCDF emissions 32% below the standard. If the facility spent half the time 25EF above the limit and half the time 25°F below the limit, the average emissions would be 7% above the standard. Similarly if the facility's instantaneous APCD temperature cycled 50°F above and below the 12-hour rolling average limit, the average dioxin emissions would be 31% above the standard, and if the facility's instantaneous APCD temperature cycled 75°F above and below the 12-hour rolling average limit, the average dioxin emissions would be 74% above the standard. Although a similar scenario could theoretically be envisioned for a facility complying with a 1-hour rolling average limit, it would require the facility to complete the up-and-down cycle much faster (i.e., once an hour), which is less likely to occur. Thus, one-hour limits in such a case better assure compliance with the emission standard than do 12-hour limits.

Consider another example facility for which an APCD temperature of 400°F corresponds to PCDD/PCDF emissions at the standard. To be safe, this facility typically operates 10°F below the limit, at 390°F and emits PCDD/PCDF at 86% of the standard. This facility could have a 150°F spike for 30 minutes up to 540°F and still keep its 12-hour rolling average temperature at about 396°F (a safe 4°F below the hourly rolling average limit). Its PCDD/PCDF emission rate for that 30-minute spike would increase by an order of magnitude and its 12-hour rolling average PCDD/PCDF emission rate would be 18% above the standard. If that facility had to comply with a 1-hour rolling average temperature limit, it could only have a 12.5°F temperature spike for 30 minutes up to 402.5EF and still keep its 1-hour rolling average temperature at about 396°F (a safe 4°F below the rolling average limit). Its PCDD/PCDF emission rate for those 30 minutes would increase by about 20% and its 1-hour rolling average PCDD/PCDF emission rate would still be only 95% of the standard. Thus, because of the nonlinear (in this case exponential) nature of the dependence of PCDD/PCDF emissions on APCD temperature, a facility limited by a 12-hour rolling average temperature could theoretically operate with one large temperature spike in a 12-hour period and emit PCDD/PCDF above the limit; whereas, if it were limited by a 1-hour rolling average, it could operate with one lesser temperature spike every hour and remain below the limit. A one-hour rolling average is more protective and better assures compliance with the emission standard..

For Group 3 parameters, there is a threshold beyond which HAP emissions increase significantly. For combustion temperature, combustion related PIC emissions are not proportionally related to combustion temperature. More likely, as temperature decreases below some threshold lower limit, combustion becomes unstable and emissions increase dramatically. A one-hour averaging period is thus needed to better assure compliance with the standard.

The typical relationship between principal organic hazardous waste constituent (POHC) combustion efficiency and combustion temperature is shown in Figure 2-4. Chemical kinetics and experimental work indicate that destruction and removal efficiency (DRE) is a sensitive exponential function of temperature. Consider a case where, during the performance test, a DRE of 99.995% is achieved at an operating temperature of 1,835EF. During subsequent operations, the facility cycles at temperatures of 1,745EF (DRE of 99.95%) and 1,925EF (DRE of 99.9995%) during equal 6-hour time periods to maintain compliance on a 12-hour basis (with swings of about 90EF). The resulting average DRE over this time period is essentially 99.97% (dominated by the poor performance at the lower temperature), which is worse than that demonstrated in the performance test (this assumes a constant feed of POHC during subsequent operations). Whereas at first glance this difference in DRE appears to be minor, it actually results in significant increases in organic HAP emissions. For example, if chlorobenzene was being fed to a combustor at a feedrate of 1,000 lbs/day, an average DRE of 99.995% would result in a mass emission rate of chlorobenzene of 0.05 lbs/day. If the source instead achieves an average 99.97 DRE, the resultant chlorobenzene emissions would be approximately 0.3 lbs/day, or higher by a factor of six. One-hour averages would make it less likely that a source could cycle its temperature above and below the average levels demonstrated in the performance test such that organic HAP emissions during normal operations would be higher than those demonstrated during the performance test.

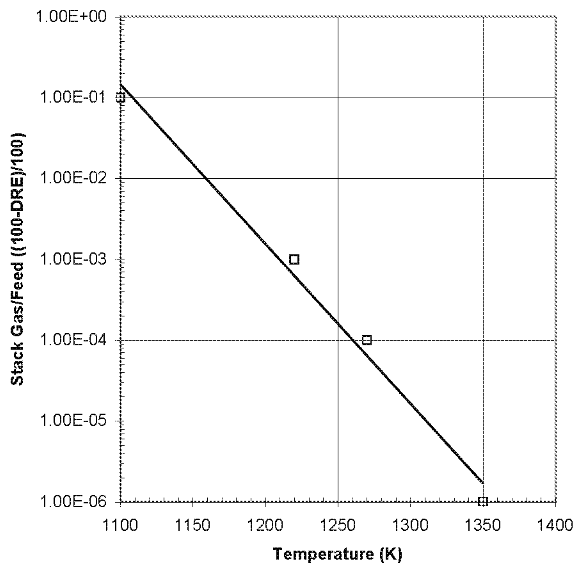


Figure 2-4. Relationship between combustion temperature and DRE for chlorobenzene.

Similarly, a 1-hour averaging period is appropriate for minimum catalytic oxidizer operating temperature because if the catalytic oxidizer goes below a threshold temperature it can no longer support the PIC destruction reactions and PIC emissions increase dramatically.

High temperature spikes have the potential to release large amounts of organics and volatile metals that have been captured in the carbon bed over its operational lifetime. Thus, it may be especially important to control flue gas and bed temperatures on a short term basis to ensure that prolonged high temperature spikes due not occur. The final rule specifies that this parameter be limited on a 1-hour rolling average basis; however, it may be appropriate, on a site-specific basis, to set a conservative upper temperature limit to be complied with on a 10-minute rolling average basis, or on an instantaneous basis, if the design or operating history suggests that significant temperature swings might occur.

For Group 4 parameters, the limit is based on manufacturer specifications and is designed to prevent damaging the equipment. For example, if a catalytic oxidizer gets too hot, the catalyst may be damaged and it may no longer be as effective at oxidizing organic HAP. Since such damage can occur quickly, a 1-hour averaging period is appropriate to prevent catalyst damage and to assure subsequent compliance with the standard.

Group 5 parameters (maximum hazardous waste feedrate and maximum flue gas flowrate), although they have a nonlinear effect on HAP emissions, are considered of secondary importance because there are other, more direct, indicators/controls on HAP emissions. Each can have a nonlinear effect on DRE and on emissions of organic HAP. As the waste feedrate increases beyond the threshold which consumes all available oxygen, emissions of organic HAP can go from levels of essentially zero to levels of significant concern. Similarly, flue gas flowrate increases can affect flame stability and gas phase residence time in ways that can have a nonlinear effect on HAP emissions. Thus, it is appropriate to set limits on these parameters on a 1-hour rolling average basis. However, since there are other parameters, such as combustion chamber temperature and CO and/or HC, which serve as more important controls and indicators of organic HAP emissions, it is appropriate to set 1-hour rolling average limits on these Group 5 parameters less stringently, based on maximum rather than average values demonstrated in the comprehensive performance test.

The operating parameters subject to 1-hour rolling average limits, as listed in the above five groups, are all easily controlled on a 1-hour basis. Measurement and control systems are available with adequate sensitivity and response time to make these averaging periods achievable. Table 2-3 lists examples of measurement and control systems for each 1-hour parameter. The response times of the measurement techniques listed in the table are all fast (i.e., well under one hour). Most of the control techniques (e.g., those relying on screw feeders, control valves, or voltage controllers) have response times well under one hour. Others with slower control system response times include:

- Minimum pressure drop across a low energy wet scrubber, for which the limit is based on manufacturer specifications. A fast way of controlling this parameter is to increase the flue gas flowrate by increasing the fuel/waste/air input to the system; however, this may conflict with limits on the maximum flue gas flowrate. Although the response time for the control technique listed in the table (shut down for maintenance) is slow, because this parameter is set based on manufacturer specifications (rather than on performance test conditions), the pressure drop in normal operation is expected to be comfortably above the limit, so fast control is not needed. The 1-hour average limit is needed to guard against sudden decreases in the pressure drop (as might result from maldistribution of the scrubber liquid) which could result in sudden increases in emissions of HCl and chorine.

- Scrubber liquid pH. Although the control technique (adding caustic to the scrubber water) is typically slow, pH changes slowly, so it is easy to predict when additional caustic will be needed and take action well in advance to prevent exceeding the 1-hour average limit.

- Minimum pressure drop across a high-energy scrubber. An automatically-controlled variable-throat high-energy scrubber should have no difficulty responding quickly enough to meet a one-hour rolling average for this parameter; however, a one-hour averaging period may be difficult to meet for scrubbers with non-automated variable throats. Facilities having scrubbers with fixed throats may find this parameter in conflict with the limit on the maximum flue gas flowrate. In situations where a 1-hour averaging period is not achievable for a specific parameter, a facility may need to petition the Agency for use of an alternative monitoring method under §63.1209(g)(1).

Table 2-3. Measurement and Control Systems for 1-Hour Average Parameters

Parameter	Example Measurement Technique	Example Control Technique
Carbon/Inhibitor/Sorbent Injection Rate	Scale/Timer	Screw Feeder RPM
Carrier Fluid Flowrate	Orifice Meter	Control Valve on Carrier Fluid
Fabric Filter Pressure Drop	Pressure Transducer	Bag Cleaning Frequency, Bag Maintenance/Replacement
ESP or IWS Power Input	Voltage-Current Meter	Voltage Controller
High-Energy Wet Scrubber Pressure Drop	Pressure Transducer	Change Area of Variable Throat
Low Energy Wet Scrubber Pressure Drop	Pressure Transducer	Shut Down for Maintenance (e.g., repair/replace packing)
Liquid Feed Pressure to Low Energy Wet Scrubber	Pressure Transducer	Control Valve on Scrubber Liquid
Wet Scrubber Liquid Feedrate or Liquid to Gas Ratio	Orifice Meter	Control Valve on Scrubber Liquid
Temperature at Inlet to Dry Particulate Matter Control Device or Lightweight Aggregate Kilns, Temperature Exiting Kiln	Thermocouple	Control Valve on Quench Water or Fuel
Catalytic Oxidizer Temperature	Thermocouple	Control Valve on Fuel or Quench Water
Combustion Chamber Temperature	Thermocouple	Control Valve on Fuel
Carbon Bed Temperature	Thermocouple	Control Valve on Fuel or Quench Water
Scrubber Liquid pH	pH meter	Add Caustic
Hazardous Waste Feedrate	Scale/Timer or Liquid Flow Meter	Solids Charge Rate or Valve on Liquid Waste
Flue Gas Flowrate	Pitot/Pressure Transducer	Fuel/Air Feedrate

2.2.4 Annual (One-year) Averaging Period

Two metal HAP emissions standards (Hg and SVM for liquid fuel boilers) are based on tests that were conducted under the normal range of operating conditions (conditions making no attempt to reflect usual operating variability) with respect to the particular HAP.

For these standards, a (not-to-exceed) annual (one-year) average compliance period is used for metal feedrate limits. A one-year averaging period is selected because the standards are based on normal emissions data which are not representative of emissions attributable to the full range of normal feedrates and other operating variables. Longer averaging periods are not considered practicable for controlling metal feeds.

2.2.5 Considerations for Selecting Shorter Averaging Periods

The requirement for 10-minute averaging periods rather than one-hour averaging periods for nonlinear parameters was considered. It was concluded that it is not appropriate to require 10-minute averaging periods on a national basis. The ability to assess the potential benefit of requiring 10-minute averaging periods for all hazardous waste combustors affected by this final rule is limited significantly by the paucity of short-term, minute-by-minute, operating parameter data. Without these data, it is not possible to effectively evaluate whether operating parameter excursions occur to an extent that warrant national ten-minute averaging period requirements for all hazardous waste combustors.

Nevertheless, a 10-minute averaging period, or perhaps instantaneous limits, may be more appropriate for some parameters at some sites. The Agency, under §63.1209(g)(2), can specify additional or alternative requirements (including shorter averaging periods) on a case-by-case basis if they are necessary to better assure compliance with the emission standards. Factors that should be considered when determining whether shorter averaging periods are appropriate include:

- The difference between the source's performance test emission levels and the relevant emission standard. For example, it may be appropriate to require shorter than one-hour averaging times for a source which demonstrates in its comprehensive performance test emissions which are only slightly below the standard, and which has operating parameters which vary significantly within a one-hour time frame.

- The ability of a source to effectively control operating parameter excursions to levels achieved during the performance test. For example, it may be appropriate to require shorter than one-hour averaging times for a source which demonstrates very stable operating parameters and emissions which are only slightly below the standard in its comprehensive performance test, but shows considerable variability in its operating parameter values during normal operation.

- The source's previous compliance history regarding operating parameter limit exceedances. For example, if a source repeatedly submits excess exceedance reports because it has more than 10 exceedances in a 60 day period, or if it is apparent from an excess exceedance report that the source is unable to consistently comply with hourly rolling average operating limits, it may be appropriate to impose shorter averaging periods for certain parameters.

In cases where 10-minute averaging periods are imposed, the Agency will consider giving sources the option of complying with a single 10-minute limit set based on the average conditions demonstrated in the comprehensive performance test, or of complying with dual limits: a 10-minute limit based on the extreme conditions demonstrated in the comprehensive performance test and a 1-hour limit based on the average conditions demonstrated in the comprehensive performance test.

2.2.6 Option to Use Shorter Averaging Periods

The final rule explicitly allows sources to use averaging periods for operating parameters shorter than those specified in §63.1209. See §63.1209(r). That paragraph explains that the averaging periods specified in §63.1209 are not-to-exceed averaging periods. For example, a source may elect to use a 1-hour rolling average rather than the 12-hour rolling average specified in §63.1209(l)(1)(i) for the mercury feedrate limit.

We provide the option to use shorter averaging periods because averaging periods shorter than those specified result in more stringent control of the parameter. With a shorter averaging period, variability of the parameter must be better controlled which should minimize the frequency, duration, and magnitude of excursions above the average value.

Explicitly allowing shorter averaging periods is less burdensome on both permitting authorities and regulated sources than using the alternative monitoring provisions of §63.8(f) to request use of a shorter averaging period.[1]

A source may choose to use a shorter averaging period than specified because: (1) data management is simpler with shorter averaging periods (i.e., fewer data to manage); and (2) the "recovery time" following an automatic waste feed cutoff (AWFCO) to allow the parameter to return to the compliance level is shorter with a shorter averaging period, and thus, a source may restart the hazardous waste feed more quickly after an AWFCO.

2.3 Setting Operating Parameter Limits

Operating parameter limits are set:

[1] We note that sources currently must use §63.8(f) to request approval from the Administrator for shorter averaging periods because a change in the averaging period is a major change defined in §63.90. Approval of major changes is not delegated to the permitting authority and thus cannot be handled under §63.1209(g)(1).

- Based on comprehensive performance test results;
- From equipment manufacturer and/or designer recommended specifications; or
- At a specified value (e.g., an ambient pressure combustion chamber pressure limit).

2.3.1 Comprehensive Performance Test Results

The majority of the operating parameter limits are set from the conditions demonstrated in the comprehensive performance test. Specifically, for almost all of these operating parameters, the limits are calculated as the average of the average operating parameter level for each performance test run. The average for each test run is calculated as the sum of the one-minute averages divided by the number of one-minute averages taken in the run.

As an example, Figure 2-5 (and Table 2-4) show one-minute average data and hourly rolling average data for an unspecified operating parameter over three runs of a comprehensive performance test. Run 1 has an average value of 48.7. It is calculated as the average of the 185 values listed in the one-minute average column for that run. Similarly, the 52.6 average value for Run 2 is the average of the 190 values listed in the one-minute average column for Run 2 and the 51.9 value for Run 3 is the average of the 180 values listed in the one-minute average column for Run 3. The 1-hour average limit for this parameter, calculated from this performance test is the average of the averages from the three runs [(48.7 + 52.6 + 51.9)/3 = 51.1]. Note that it is not calculated as the sum of all one-minute averages over all runs divided by the number of 1 minute averages over all runs. That method would give a disproportionate weighting to the run with the longest duration.

Alternatively, for two parameters -- maximum hazardous waste feedrate and maximum flue gas flowrate -- hourly rolling average operating limits are determined as the average of the maximum hourly rolling average for each performance test run. For example, if the operating parameter shown in Figure 2-5 (and Table 2-4) were one of these two parameters, then the operating limit would be 53.6 which is the sum of the maximum hourly rolling averages observed in Run 1 (52.0), Run 2 (55.9), and Run 3 (53.0).

Table 2-4: Example Calculation of Hourly Rolling Average Operating Limits

Run 1

	1 Min			1 Min			1 Min	
Min	Avg	HRA	Min	Avg	HRA	Min	Avg	HRA
1	50.8		65	56.5	46.3	129	49.5	50.3
2	55.3		66	51.0	46.2	130	48.8	50.2
3	51.8		67	53.3	46.3	131	49.8	50.2
4	56.0		68	51.8	46.4	132	51.8	50.2
5	57.8		69	47.3	46.3	133	49.8	50.2
6	54.0		70	51.0	46.4	134	47.5	50.2
7	48.5		71	53.3	46.6	135	55.3	50.2
8	47.0		72	51.8	46.7	136	56.5	50.2
9	48.3		73	49.8	46.8	137	51.5	50.1
10	47.8		74	47.0	47.0	138	50.3	50.0
11	44.3		75	54.8	47.2	139	55.8	50.0
12	42.0		76	56.0	47.4	140	60.3	50.1
13	42.0		77	56.3	47.7	141	60.0	50.4
14	40.5		78	58.3	48.0	142	55.8	50.5
15	39.0		79	55.3	48.1	143	52.3	50.5
16	43.0		80	50.3	48.2	144	53.3	50.5
17	39.5		81	45.0	48.1	145	56.3	50.7
18	42.0		82	48.8	48.2	146	58.0	50.9
19	46.0		83	55.3	48.3	147	58.0	51.2
20	49.3		84	49.3	48.3	148	58.8	51.6
21	45.8		85	46.0	48.4	149	54.3	51.8
22	44.5		86	44.3	48.3	150	51.5	52.0
23	48.0		87	40.5	48.2	151	47.8	52.0
24	48.8		88	39.0	48.1	152	39.3	51.9
25	44.5		89	40.0	48.0	153	38.3	51.7
26	46.5		90	41.5	47.9	154	37.3	51.4
27	46.3		91	46.3	47.8	155	38.8	51.2
28	47.0		92	46.0	47.7	156	41.8	51.1
29	46.5		93	48.0	47.8	157	42.8	51.0
30	47.0		94	53.3	47.9	158	43.5	51.0
31	51.3		95	53.5	48.0	159	45.8	51.0
32	51.8		96	49.0	48.1	160	45.3	50.9
33	45.0		97	46.3	48.1	161	46.0	50.8
34	44.8		98	42.5	48.0	162	44.8	50.6
35	46.3		99	46.8	47.9	163	43.3	50.3
36	47.5		100	51.8	48.1	164	42.3	50.1
37	46.3		101	51.5	48.2	165	41.5	49.8
38	48.0		102	57.8	48.6	166	45.3	49.6
39	49.8		103	60.0	48.9	167	46.5	49.6
40	42.5		104	58.0	49.1	168	48.8	49.5
41	41.3		105	59.3	49.3	169	48.8	49.6
42	39.0		106	53.8	49.5	170	48.3	49.6
43	40.8		107	50.0	49.5	171	53.0	49.8
44	43.3		108	50.3	49.6	172	51.8	49.9
45	46.3		109	47.3	49.5	173	54.3	50.1
46	45.0		110	44.8	49.4	174	53.0	50.2
47	46.8		111	42.5	49.3	175	51.3	50.3
48	46.3		112	43.0	49.2	176	48.5	50.3
49	50.5		113	42.8	49.2	177	44.0	50.1
50	52.5		114	46.5	49.3	178	43.8	50.0
51	47.8		115	50.5	49.5	179	50.0	49.8
52	48.3		116	47.0	49.5	180	50.3	49.7
53	42.5		117	53.5	49.7	181	40.8	49.5
54	44.0		118	53.5	49.9	182	41.5	49.3
55	40.8		119	58.0	50.2	183	45.0	49.1
56	42.0		120	57.3	50.4	184	51.5	49.1
57	42.3		121	55.3	50.5	185	49.3	49.0
58	41.3		122	53.3	50.5			
59	42.5		123	52.8	50.4			
60	42.5	46.1	124	52.8	50.3			
61	48.5	46.1	125	54.8	50.3			
62	56.0	46.1	126	52.5	50.3			
63	60.8	46.3	127	51.8	50.3			
64	57.5	46.3	128	49.5	50.2			
						Avg	48.7	
						Max		52.0

Run 2

	1 Min			1 Min			1 Min	
Min	Avg	HRA	Min	Avg	HRA	Min	Avg	HRA
1	50.0		65	43.5	48.9	129	58.0	55.7
2	49.3		66	48.0	49.1	130	51.8	55.7
3	46.0		67	51.0	49.2	131	51.5	55.8
4	43.8		68	52.5	49.3	132	50.5	55.8
5	42.0		69	51.8	49.5	133	49.8	55.9
6	39.8		70	51.8	49.6	134	46.5	55.8
7	44.3		71	46.3	49.7	135	47.0	55.7
8	45.8		72	46.8	49.7	136	44.8	55.5
9	41.5		73	47.3	49.6	137	44.3	55.4
10	41.0		74	52.5	49.5	138	45.5	55.2
11	42.3		75	53.0	49.4	139	48.3	55.1
12	47.5		76	54.3	49.4	140	52.3	55.0
13	51.3		77	53.0	49.4	141	54.3	54.9
14	59.0		78	53.5	49.4	142	55.5	54.8
15	56.8		79	57.0	49.4	143	52.0	54.7
16	56.5		80	59.5	49.5	144	52.8	54.6
17	54.3		81	58.5	49.6	145	53.5	54.6
18	52.8		82	59.0	49.7	146	53.8	54.5
19	57.0		83	58.8	49.8	147	50.8	54.3
20	54.8		84	57.8	49.7	148	55.0	54.2
21	52.5		85	59.3	49.8	149	56.3	54.1
22	52.8		86	59.5	49.8	150	56.5	54.1
23	54.8		87	59.3	49.9	151	59.0	54.1
24	60.8		88	59.5	50.0	152	56.5	54.1
25	56.3		89	62.8	50.1	153	57.0	54.0
26	55.5		90	59.8	50.2	154	58.8	54.2
27	54.5		91	58.5	50.3	155	59.5	54.5
28	55.3		92	58.3	50.4	156	52.5	54.5
29	55.3		93	57.5	50.5	157	48.3	54.5
30	51.0		94	48.0	50.4	158	50.5	54.4
31	53.0		95	45.5	50.3	159	51.0	54.4
32	52.3		96	48.5	50.2	160	49.5	54.4
33	51.3		97	50.5	50.0	161	52.5	54.3
34	54.3		98	53.3	49.8	162	57.5	54.3
35	53.0		99	52.8	49.7	163	57.3	54.3
36	55.0		100	52.8	49.6	164	56.5	54.2
37	60.0		101	56.3	49.7	165	56.3	54.1
38	65.3		102	58.3	49.9	166	55.5	54.1
39	64.0		103	59.0	50.1	167	57.3	54.1
40	57.8		104	60.3	50.4	168	56.3	54.1
41	50.5		105	59.3	50.6	169	57.3	54.3
42	45.5		106	56.3	50.9	170	57.3	54.4
43	47.3		107	58.5	51.2	171	58.3	54.4
44	43.5		108	54.3	51.4	172	57.0	54.3
45	42.5		109	48.8	51.5	173	58.0	54.3
46	39.5		110	52.0	51.7	174	57.0	54.3
47	39.0		111	58.0	51.9	175	56.0	54.3
48	44.5		112	60.5	52.2	176	58.8	54.3
49	41.5		113	58.5	52.4	177	61.3	54.4
50	42.0		114	57.0	52.6	178	56.8	54.4
51	43.5		115	58.5	52.8	179	56.5	54.4
52	43.0		116	55.8	53.1	180	56.0	54.4
53	45.8		117	57.5	53.4	181	57.3	54.5
54	46.5		118	54.8	53.7	182	53.8	54.6
55	44.3		119	55.5	53.8	183	58.3	54.6
56	40.0		120	56.5	54.0	184	57.5	54.7
57	38.8		121	50.8	54.1	185	58.5	54.6
58	40.3		122	49.5	54.3	186	59.0	54.6
59	46.3		123	56.0	54.5	187	54.0	54.6
60	45.8	49.3	124	56.5	54.8	188	48.3	54.3
61	43.5	49.2	125	59.3	55.1	189	40.8	54.0
62	38.8	49.0	126	59.3	55.3	190	38.8	53.8
63	41.5	49.0	127	59.0	55.4			
64	39.5	48.9	128	63.3	55.6			
						Avg	52.6	
						Max		55.9

Run 3

	1 Min			1 Min			1 Min	
Min	Avg	HRA	Min	Avg	HRA	Min	Avg	HRA
1	49.0		65	47.5	52.4	129	44.5	51.5
2	51.0		66	48.8	52.1	130	44.3	51.4
3	52.5		67	53.3	51.9	131	46.3	51.3
4	56.3		68	54.5	51.9	132	55.3	51.2
5	61.5		69	48.0	51.6	133	54.0	51.2
6	63.3		70	50.3	51.4	134	47.8	51.0
7	64.3		71	55.0	51.4	135	48.5	50.9
8	59.0		72	59.0	51.4	136	50.8	50.8
9	62.0		73	55.8	51.3	137	51.8	50.7
10	61.3		74	56.5	51.2	138	46.5	50.6
11	60.5		75	57.8	51.2	139	52.8	50.5
12	56.5		76	56.3	51.2	140	53.5	50.5
13	59.3		77	54.8	51.1	141	58.0	50.5
14	62.0		78	53.0	51.0	142	59.8	50.6
15	59.0		79	58.0	51.0	143	58.0	50.6
16	59.3		80	57.0	50.9	144	59.3	50.8
17	59.8		81	57.8	50.8	145	55.0	50.8
18	58.8		82	55.8	50.8	146	52.8	50.9
19	59.0		83	55.5	50.7	147	48.8	50.9
20	64.5		84	50.0	50.6	148	51.3	50.9
21	62.3		85	49.8	50.4	149	50.0	50.9
22	57.0		86	49.0	50.2	150	48.5	50.8
23	57.3		87	47.3	49.9	151	46.8	50.6
24	59.0		88	51.0	49.8	152	43.5	50.4
25	61.8		89	54.0	49.7	153	42.8	50.1
26	59.0		90	53.5	49.6	154	43.0	49.7
27	64.0		91	55.0	49.6	155	44.5	49.3
28	62.0		92	58.5	49.8	156	51.5	48.9
29	57.3		93	61.8	50.0	157	57.5	48.8
30	59.5		94	66.8	50.3	158	61.0	48.9
31	56.5		95	69.5	50.6	159	59.0	49.1
32	47.8		96	70.8	51.0	160	54.3	49.3
33	47.3		97	63.8	51.4	161	56.3	49.6
34	50.0		98	57.3	51.6	162	57.0	49.9
35	49.0		99	48.5	51.8	163	54.3	50.0
36	46.8		100	42.5	51.8	164	49.3	50.1
37	42.0		101	39.0	51.8	165	48.8	50.1
38	41.0		102	38.8	51.8	166	53.5	50.2
39	40.5		103	44.3	51.8	167	54.8	50.3
40	39.5		104	47.8	51.9	168	58.0	50.4
41	40.3		105	48.0	51.9	169	53.5	50.5
42	40.8		106	47.0	51.9	170	50.3	50.5
43	40.5		107	50.0	52.1	171	51.5	50.5
44	45.3		108	47.8	52.1	172	51.0	50.5
45	47.3		109	50.0	52.2	173	51.5	50.4
46	44.0		110	52.5	52.1	174	51.3	50.5
47	42.0		111	50.0	52.0	175	55.0	50.6
48	44.5		112	52.0	51.8	176	56.3	50.7
49	48.5		113	52.5	51.6	177	50.3	50.7
50	55.3		114	48.8	51.5	178	48.3	50.8
51	59.5		115	47.8	51.5	179	48.3	50.8
52	64.0		116	48.8	51.6	180	48.0	50.8
53	61.3		117	50.8	51.7			
54	54.5		118	45.3	51.7			
55	47.3		119	45.5	51.8			
56	45.0		120	49.3	52.0			
57	44.0		121	53.0	52.2			
58	43.0		122	52.3	52.4			
59	39.8		123	44.3	52.3			
60	37.8	53.0	124	43.5	52.2			
61	40.3	52.9	125	41.8	52.1			
62	41.8	52.7	126	41.8	52.0			
63	49.3	52.7	127	42.3	51.8			
64	51.3	52.6	128	41.5	51.6			
						Avg	51.9	
						Max		53.0

Average of 1 minute averages for each run = 51.1
Average of maximum hourly rolling averages for each run = 53.6

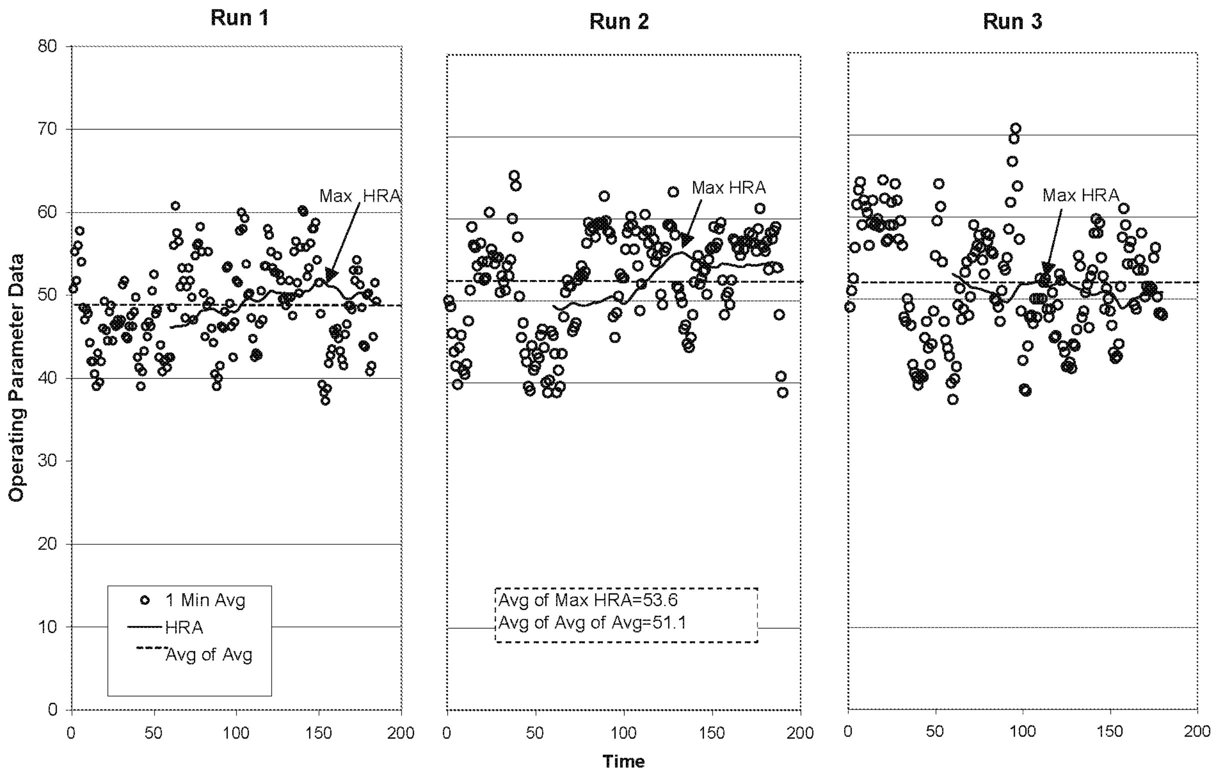


Figure 2-5. Example calculation of hourly rolling average limits.

2.3.2 Manufacturer Specifications

For a few of the operating parameters, sources may choose to set the limits based on "manufacturer specifications". These include: liquid feed pressure and pressure drop for low energy wet scrubbers, pressure drop for fabric filters, catalyst age and temperature for catalytic oxidizers, and carrier gas flowrate for sorbent injection systems. Limits must be recommended in the Agency-reviewed and approved comprehensive performance test work plan.

2.4 Complying With Operating Limits

2.4.1 Instantaneous Limits

If a source elects to comply with the combustion chamber pressure limit to control combustion system leaks, compliance must be demonstrated on an "instantaneous" basis. Measurements are made continuously without integration, and no averaging period is allowed. Unlike averaged parameters, which must be sampled a minimum of once every 15 seconds, combustion chamber pressure monitors must detect and record constantly without interruption.

Traditionally, data have been recorded in an analog fashion using a “chart pen” recorder. Alternatively, if digital recording and storage are used, the comprehensive performance test plan should request data recording and storage methods. It is suggested, to reduce data storage requirements, that data be stored only when approaching or exceeding the pressure limit, in a manner similar to that discussed in Section 23.11 for data compression allowances.

2.4.2 Rolling Average Limits

General Procedures

A rolling average for a particular monitored parameter is calculated as the average of all one-minute averages for that parameter ending at the last minute, and stretching back over the duration of the averaging period. Figure 2-6 (and Table 2-5) provides an example of an hourly rolling average calculation for three hours of data from an unspecified operating parameter. The one-hour rolling average at minute 60 (with a value of 47.5 in the table) is the average of 60 consecutive one-minute averages from minute 1 through minute 60. It is updated every minute by including the latest one-minute average and dropping the one-minute average from one hour ago. Thus, the one-hour average at minute 61 (with a value of 47.6 in the table) is the average of the one-minute averages from minute 2 through minute 61.

A one-minute average is the average of the data over a sixty second period, with data processed at least once every 15 seconds. This is the same as the approach used in the current RCRA BIF rule. The data for Figure 2-6 were taken once every 15 seconds. The one minute average for minute 1 (with a value of 48.5 in the table) is the average of the four 15-second readings (50, 50, 47, and 47 in the table) taken during minute 1.

The averaging period provides a dampening effect on the reported data. Note that the 15-second data have a considerable amount of variability. This variability is dampened (i.e., averaged out) somewhat in the one-minute averages and is dampened considerably in the 1-hour rolling averages.

For the annual (one year) averages for certain feedrate limits, compliance is updated every hour.

Table 2-5: Example Hourly Rolling Average Calculations for 3 Hrs of Data

	15 Second Readings				1 Min	Hourly
Min	15	30	45	60	Avg	Rlg Avg
1	50	50	47	47	48.5	
2	45	47	50	48	47.5	
3	47	48	51	53	49.8	
4	52	51	49	52	51.0	
5	49	47	47	44	46.8	
6	46	44	42	41	43.3	
7	41	38	42	41	40.5	
8	38	40	43	44	41.3	
9	43	40	42	42	41.8	
10	41	41	39	38	39.8	
11	40	44	43	41	42.0	
12	40	44	47	46	44.3	
13	45	45	46	43	44.8	
14	45	42	42	40	42.3	
15	40	44	46	49	44.8	
16	47	44	41	38	42.5	
17	41	40	43	45	42.3	
18	47	45	46	48	46.5	
19	47	46	46	47	46.5	
20	48	45	43	42	44.5	
21	44	45	48	47	46.0	
22	45	45	42	44	44.0	
23	46	46	46	43	45.3	
24	46	46	44	43	44.8	
25	42	44	46	49	45.3	
26	47	47	49	48	47.8	
27	45	46	44	44	44.8	
28	45	46	46	47	46.0	
29	47	45	42	44	44.5	
30	46	47	46	46	46.3	
31	47	49	50	51	49.3	
32	48	51	48	49	49.0	
33	46	44	46	47	45.8	
34	47	47	48	49	47.8	
35	52	51	54	54	52.8	
36	56	58	60	61	58.8	
37	60	56	55	55	56.5	
38	57	55	58	57	56.8	
39	59	62	61	59	60.3	
40	62	59	58	61	60.0	
41	57	60	57	56	57.5	
42	54	53	53	55	53.8	
43	52	53	55	57	54.3	
44	54	54	51	52	52.8	
45	49	52	55	54	52.5	
46	55	53	55	55	54.5	
47	53	51	54	57	53.8	
48	55	53	51	50	52.3	
49	47	47	48	45	46.8	
50	42	41	39	42	41.0	
51	43	44	43	44	43.5	
52	44	43	41	40	42.0	
53	38	41	41	39	39.8	
54	37	39	39	37	38.0	
55	36	39	37	40	38.0	
56	40	39	38	41	39.5	
57	38	41	44	45	42.0	
58	48	49	52	55	51.0	
59	54	55	55	57	55.3	
60	59	58	60	60	59.3	47.5

	15 Second Readings				1 Min	Hourly
Min	15	30	45	60	Avg	Rlg Avg
61	62	59	56	57	58.5	47.6
62	58	55	55	58	56.5	47.8
63	60	56	57	58	57.8	47.9
64	57	59	59	58	58.3	48.1
65	55	54	54	51	53.5	48.2
66	54	52	51	51	52.0	48.3
67	50	49	48	51	49.5	48.5
68	50	47	50	50	49.3	48.6
69	48	50	51	53	50.5	48.7
70	50	51	49	49	49.8	48.9
71	47	49	50	50	49.0	49.0
72	47	44	42	41	43.5	49.0
73	44	45	48	49	46.5	49.0
74	47	45	48	47	46.8	49.1
75	47	50	49	47	48.3	49.2
76	49	52	53	52	51.5	49.3
77	49	48	46	46	47.3	49.4
78	48	50	50	53	50.3	49.5
79	52	55	58	60	56.3	49.6
80	62	60	58	61	60.3	49.9
81	63	61	59	60	60.8	50.1
82	57	55	58	58	57.0	50.4
83	56	53	53	52	53.5	50.5
84	55	56	54	57	55.5	50.7
85	59	59	61	58	59.3	50.9
86	60	60	62	60	60.5	51.1
87	60	57	58	60	58.8	51.4
88	62	58	61	57	59.5	51.6
89	59	57	58	57	57.8	51.8
90	57	58	60	56	57.8	52.0
91	54	54	56	55	54.8	52.1
92	53	54	51	50	52.0	52.1
93	47	48	47	46	47.0	52.2
94	47	47	50	52	49.0	52.2
95	55	53	50	53	52.8	52.2
96	51	53	55	57	54.0	52.1
97	59	56	55	52	55.5	52.1
98	52	53	51	52	52.0	52.0
99	53	56	58	60	56.8	51.9
100	59	61	57	56	58.3	51.9
101	54	53	55	53	53.8	51.8
102	53	50	51	48	50.5	51.8
103	50	48	50	50	49.5	51.7
104	49	47	47	50	48.3	51.6
105	50	52	49	48	49.8	51.6
106	47	50	48	51	49.0	51.5
107	54	52	53	53	53.0	51.5
108	51	52	55	55	53.3	51.5
109	54	56	53	55	54.5	51.6
110	55	58	56	53	55.5	51.9
111	50	47	49	46	48.0	52.0
112	49	48	50	51	49.5	52.1
113	54	54	51	52	52.8	52.3
114	51	50	50	51	50.5	52.5
115	51	50	50	50	50.3	52.7
116	47	50	52	55	51.0	52.9
117	55	57	58	58	57.0	53.1
118	60	61	58	59	59.5	53.3
119	61	59	62	60	60.5	53.4
120	61	60	60	58	59.8	53.4

	15 Second Readings				1 Min	Hourly
Min	15	30	45	60	Avg	Rlg Avg
121	57	58	55	57	56.8	53.4
122	55	53	56	57	55.3	53.3
123	57	54	57	59	56.8	53.3
124	59	58	61	59	59.3	53.3
125	61	61	57	54	58.3	53.4
126	53	52	53	55	53.3	53.4
127	58	59	57	55	57.3	53.6
128	56	59	60	58	58.3	53.7
129	58	61	59	57	58.8	53.9
130	59	61	57	57	58.5	54.0
131	56	59	58	58	57.8	54.1
132	56	55	57	59	56.8	54.4
133	61	60	59	59	59.8	54.6
134	56	55	54	52	54.3	54.7
135	51	51	48	45	48.8	54.7
136	42	45	43	45	43.8	54.6
137	46	45	47	47	46.3	54.6
138	49	51	51	51	50.5	54.6
139	51	48	50	48	49.3	54.5
140	47	47	46	45	46.3	54.2
141	44	47	44	44	44.8	54.0
142	43	43	44	42	43.0	53.7
143	41	39	37	41	39.5	53.5
144	43	46	49	46	46.0	53.3
145	46	49	52	53	50.0	53.2
146	53	50	51	50	51.0	53.0
147	52	51	48	46	49.3	52.9
148	44	44	42	41	42.8	52.6
149	38	38	37	39	38.0	52.3
150	41	40	44	46	42.8	52.0
151	46	44	46	49	46.3	51.9
152	52	51	52	52	51.8	51.9
153	53	53	52	50	52.0	51.9
154	52	49	52	53	51.5	52.0
155	55	58	59	59	57.8	52.1
156	60	61	60	61	60.5	52.2
157	58	55	53	55	55.3	52.2
158	56	58	58	60	58.0	52.3
159	61	61	59	59	60.0	52.3
160	58	59	61	62	60.0	52.4
161	58	61	60	62	60.3	52.5
162	61	58	56	54	57.3	52.6
163	51	51	52	55	52.3	52.6
164	58	55	56	59	57.0	52.8
165	60	60	57	59	59.0	52.9
166	58	56	56	54	56.0	53.0
167	56	57	55	52	55.0	53.1
168	52	49	50	51	50.5	53.0
169	48	50	53	56	51.8	53.0
170	58	57	55	57	56.8	53.0
171	58	57	57	58	57.5	53.2
172	60	57	60	56	58.3	53.3
173	56	55	52	54	54.3	53.3
174	57	57	54	51	54.8	53.4
175	51	50	52	52	51.3	53.4
176	51	48	49	49	49.3	53.4
177	49	47	48	50	48.5	53.2
178	47	49	49	50	48.8	53.1
179	48	49	50	53	50.0	52.9
180	56	58	56	54	56.0	52.8

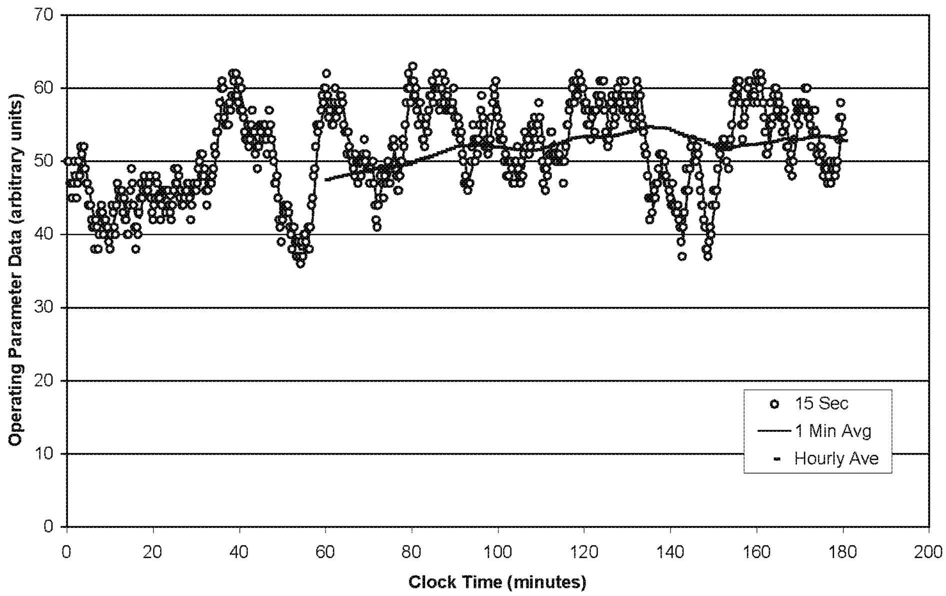


Figure 2-6. Example operating parameter hourly rolling average for 3 hours of data.

Initial Calculation

The first determination of an hourly rolling average (and compliance with limits) is made one hour after the rule compliance date, for both CMS and CEMS.

Intermittent Operations

If a rolling average is interrupted (i.e., when one-minute average values for a parameter are not recorded), data for that period are not counted and the rolling average is resumed when the system comes back online. For example:

- As provided in Table 2-6, where a monitor goes offline for calibration at 2:00 PM and comes back online at 2:10 PM. The hourly rolling average at 2:20 PM (with a value of 51.7 in the table) includes data from the 50 minutes between 1:10 and 2:00 and the 10 minutes between 2:10 and 2:20; but it does not include the data for the period from 2:00 to 2:10 when the instrument was offline.

Table 2-6: Example HRA when CEMS goes offline

	15 Second Readings				1 Min	Hourly		15 Second Readings				1 Min	Hourly		15 Second Readings				1 Min	Hourly
Min	15	30	45	60	Avg	Rlg Avg	Min	15	30	45	60	Avg	Rlg Avg	Min	15	30	45	60	Avg	Rlg Avg
12:01	50	47	48	48	48.3		13:01	48	50	52	52	50.5	43.9	14:01	-	-	-	-	-	offline
12:02	45	48	50	49	48.0		13:02	50	50	47	46	48.3	43.9	14:02	-	-	-		-	offline
12:03	47	46	45	48	46.5		13:03	49	51	53	54	51.8	44.0	14:03	-	-	-	-	-	offline
12:04	51	52	49	50	50.5		13:04	54	52	51	51	52.0	44.0	14:04	-	-	-	-	-	offline
12:05	47	48	49	47	47.8		13:05	53	56	57	58	56.0	44.1	14:05	-	-	-	-	-	offline
12:06	45	42	42	41	42.5		13:06	61	63	59	57	60.0	44.4	14:06	-	-	-	-	-	offline
12:07	42	39	41	40	40.5		13:07	56	57	59	59	57.8	44.7	14:07	-	-	-	-	-	offline
12:08	43	42	42	40	41.8		13:08	58	59	60	62	59.8	45.0	14:08	-	-	-	-	-	offline
12:09	39	40	39	40	39.5		13:09	59	62	63	60	61.0	45.4	14:09	-	-	-	-	-	offline
12:10	39	37	37	38	37.8		13:10	59	60	62	58	59.8	45.7	14:10	-	-	-	-	-	offline
12:11	42	43	40	41	41.5		13:11	56	54	54	51	53.8	45.9	14:11	60	59	57	54	57.5	52.9
12:12	39	40	39	42	40.0		13:12	50	47	45	45	46.8	46.0	14:12	52	50	53	50	51.3	53.0
12:13	42	44	41	42	42.3		13:13	47	45	47	47	46.5	46.1	14:13	51	54	54	51	52.5	53.0
12:14	44	41	42	45	43.0		13:14	47	47	47	48	47.3	46.2	14:14	48	50	51	48	49.3	52.9
12:15	43	44	41	39	41.8		13:15	50	47	48	46	47.8	46.3	14:15	51	54	54	52	52.8	52.9
12:16	41	38	42	43	41.0		13:16	45	43	45	45	44.5	46.3	14:16	52	50	50	48	50.0	52.7
12:17	43	43	41	38	41.3		13:17	46	49	48	51	48.5	46.5	14:17	49	46	48	45	47.0	52.5
12:18	36	34	37	41	37.0		13:18	54	52	53	54	53.3	46.7	14:18	42	43	41	44	42.5	52.2
12:19	40	42	40	44	41.5		13:19	55	55	55	57	55.5	47.0	14:19	47	46	47	44	46.0	52.0
12:20	41	43	41	39	41.0		13:20	59	59	61	62	60.3	47.3	14:20	42	43	45	47	44.3	51.7
12:21	41	44	42	42	42.3		13:21	60	59	59	57	58.8	47.6	14:21	49	46	43	40	44.5	51.6
12:22	42	40	44	41	41.8		13:22	55	55	58	61	57.3	47.8	14:22	39	38	36	38	37.8	51.4
12:23	38	37	37	40	38.0		13:23	62	62	58	58	60.0	48.2	14:23	37	35	34	34	35.0	51.2
12:24	39	42	45	45	42.8		13:24	60	58	55	53	56.5	48.4	14:24	34	35	33	32	33.5	51.0
12:25	48	46	45	45	46.0		13:25	54	52	53	56	53.8	48.5	14:25	33	37	38	38	36.5	50.8
12:26	42	39	39	41	40.3		13:26	56	56	54	56	55.5	48.8	14:26	36	39	38	36	37.3	50.7
12:27	39	39	40	41	39.8		13:27	59	61	60	59	59.8	49.1	14:27	36	37	35	36	36.0	50.5
12:28	41	38	42	42	40.8		13:28	58	60	62	59	59.8	49.5	14:28	35	34	36	35	35.0	50.2
12:29	41	40	38	42	40.3		13:29	62	59	56	58	58.8	49.8	14:29	39	37	37	38	37.8	49.9
12:30	39	37	36	40	38.0		13:30	56	54	53	53	54.0	50.0	14:30	39	38	40	42	39.8	49.6
12:31	42	45	46	49	45.5		13:31	54	54	55	55	54.5	50.2	14:31	42	45	47	46	45.0	49.3
12:32	51	48	47	45	47.8		13:32	55	57	56	55	55.8	50.3	14:32	48	45	43	42	44.5	49.1
12:33	45	44	47	46	45.5		13:33	52	54	53	50	52.3	50.4	14:33	43	43	43	40	42.3	48.8
12:34	49	46	46	44	46.3		13:34	47	50	52	49	49.5	50.5	14:34	40	41	41	44	41.5	48.6
12:35	47	50	48	47	48.0		13:35	46	44	41	44	43.8	50.4	14:35	41	39	39	43	40.5	48.3
12:36	44	43	45	46	44.5		13:36	44	41	38	42	41.3	50.4	14:36	46	49	50	51	49.0	48.2
12:37	49	48	50	51	49.5		13:37	42	41	43	44	42.5	50.2	14:37	48	45	42	45	45.0	48.0
12:38	50	51	50	51	50.5		13:38	43	46	43	46	44.5	50.1	14:38	44	45	43	40	43.0	47.7
12:39	52	51	51	53	51.8		13:39	43	43	42	41	42.3	50.0	14:39	41	42	41	39	40.8	47.4
12:40	51	48	48	51	49.5		13:40	38	37	36	36	36.8	49.8	14:40	43	46	48	50	46.8	47.3
12:41	53	52	52	50	51.8		13:41	39	38	36	35	37.0	49.5	14:41	47	46	44	44	45.3	47.1
12:42	50	47	47	45	47.3		13:42	36	39	38	38	37.8	49.4	14:42	47	46	46	49	47.0	47.0
12:43	46	46	44	42	44.5		13:43	41	41	44	45	42.8	49.3	14:43	49	46	43	46	46.0	46.9
12:44	39	37	38	42	39.0		13:44	47	44	44	44	44.8	49.4	14:44	46	43	41	39	42.3	46.8
12:45	43	42	40	40	41.3		13:45	42	41	42	45	42.5	49.4	14:45	39	40	42	40	40.3	46.7
12:46	43	46	45	45	44.8		13:46	44	45	47	50	46.5	49.5	14:46	44	47	44	41	44.0	46.8
12:47	48	45	45	44	45.5		13:47	52	51	48	47	49.5	49.5	14:47	39	40	38	40	39.3	46.7
12:48	47	47	47	45	46.5		13:48	50	53	55	56	53.5	49.7	14:48	44	46	46	46	45.5	46.7
12:49	44	45	45	47	45.3		13:49	59	61	57	54	57.8	49.9	14:49	48	48	49	46	47.8	46.8
12:50	46	46	46	43	45.3		13:50	54	52	55	58	54.8	50.0	14:50	47	46	43	43	44.8	46.9
12:51	40	39	38	42	39.8		13:51	61	63	60	60	61.0	50.4	14:51	45	47	44	42	44.5	47.1
12:52	39	43	43	41	41.5		13:52	62	62	64	64	63.0	50.7	14:52	44	44	42	40	42.5	47.1
12:53	40	38	36	40	38.5		13:53	62	64	61	63	62.5	51.1	14:53	44	44	44	44	44.0	47.2
12:54	40	38	40	42	40.0		13:54	62	60	62	60	61.0	51.5	14:54	44	44	43	40	42.8	47.1
12:55	43	40	44	46	43.3		13:55	61	60	62	61	61.0	51.8	14:55	43	46	46	46	45.3	47.2
12:56	43	46	49	48	46.5		13:56	61	57	60	60	59.5	52.0	14:56	44	46	45	46	45.3	47.2
12:57	48	45	47	44	46.0		13:57	56	57	60	58	57.8	52.2	14:57	44	47	46	49	46.5	47.1
12:58	43	46	49	50	47.0		13:58	57	59	61	61	59.5	52.4	14:58	49	48	47	49	48.3	47.0
12:59	48	49	49	46	48.0		13:59	59	59	60	62	60.0	52.6	14:59	47	48	51	51	49.3	46.9
13:00	43	45	48	50	46.5	43.8	14:00	58	60	57	58	58.3	52.8	15:00	49	48	50	51	49.5	46.8

- If a source totally shuts down (i.e., no combustion occurs) for yearly maintenance for a three week period, the first one-minute average value recorded for the parameter for the first minute of renewed operations is added to the last 59-one minute averages before the source shutdown.

After a Waste Feed Cutoff

This approach does not apply to time periods after the source initiates an AWFCO due to an exceedance of an operating parameter limit. After an AWFCO, a source must continue to monitor operating parameter limits, and must continue to calculate rolling averages unless it operates under nonhazardous waste MACT requirements pursuant to the provisions found in §63.1206(b)(1)(ii).

Compliance With Alternative MACT Standards

If the source stops burning hazardous waste and if hazardous waste no longer remains in the combustion chamber, the source may elect to comply with the nonhazardous waste MACT requirements for the source category in lieu of the HWC MACT requirements pursuant to the provisions in §63.1206(b)(1)(ii). In this situation, a source is not required to continue to record compliance parameter values for purposes of HWC MACT compliance. Before hazardous waste burning is reinitiated, a source must document in the operating record when it elects to begin complying with the HWC requirements, and must again monitor and record compliance parameter values and rolling averages (as described above) neglecting data from the period when the source operated pursuant to §63.1206(b)(1)(ii). A source must not resume burning hazardous waste until all operating parameters are in compliance with its limits.

2.5 HAP Feedrate Operating Parameter Issues

Metals Feedrate Limit Extrapolation

The "upward" extrapolation of metals feedrates and associated emissions rates during the comprehensive performance test to higher allowable feedrate and emissions rates can be requested on a site-specific basis in the Agency reviewed and approved comprehensive performance test plan. See Section 6 for details on the extrapolation procedure.

Compliance With "Normal" Emissions Standards

As discussed above, two of the metal HAP emissions standards are based on tests that were conducted under the normal range of operating conditions with respect to the particular HAP:: Hg and SVM for liquid fuel boilers.

For these standards, compliance with the HAP feedrate limit is on a (not-to-exceed) annual (one-year) rolling average basis, updated each hour.

The feedrate limit is determined as:

$$F_{Limit} = \frac{E_{HWC\,MACT}}{(1 - SRE)}$$

where:

F_{Limit} = Metal feedrate limit. For liquid fuel boilers, the limit is based on hazardous waste thermal concentration (lb/MM Btu hazardous waste)

$E_{HWC\,MACT}$ = HWC MACT emissions standard (lb/MM Btu hazardous waste for liquid fuel boilers)

SRE = SRE for HAP, as demonstrated in a comprehensive performance test (%/100). If the source does not contain an air pollution control device that is established to be consistently effective at controlling the HAP metal (through engineering judgment, previous test demonstrations), the SRE must assumed to be zero (0).

Downward Extrapolation for Normal Emissions Based Standards

The mercury and semivolatile metals standards for liquid fuel boilers are annual average emission limits complied with by establishing a rolling average feedrate limit with an averaging period not to exceed annually. This is because the emissions data used to establish the standards are more representative of normal emissions than compliance test, high end emissions.

To ensure compliance with the mercury and semivolatile metal emission standards for liquid fuel boilers, the source must document during the comprehensive performance test a system removal efficiency for the metals and back-calculate from the emission standard a maximum metal feedrate limit that must not be exceeded on an (not to exceed) annual rolling average. If the source is not equipped with an emission control system (such as activated carbon to control mercury) for the metals in question, however, the source must assume zero system removal efficiency. This is because a source that is not equipped with an emission control system may be able to document a positive system removal efficiency, but it is not likely to be reproducible. It is likely to be an artifact of the calculation of emissions and feeds rather than a removal efficiency that is reliable and reproducible.

To ensure that the source can calculate a valid, reproducible system removal efficiency for sources equipped with a control system that effectively controls the metal in question, the source may need to spike metals in the feed during the comprehensive performance test at levels that may result in emissions that are higher than the standard. This is acceptable because compliance with an emission standard derived from normal emissions data is based on compliance with an (not to exceed) annual average feedrate limit calculated as prescribed here, rather than compliance with the emission standard during the comprehensive performance test.

We have investigated whether downward extrapolation from the levels achieved during the comprehensive performance test to establish a metal feedrate limit would ensure compliance with the standard. The concern is whether SRE may decrease at lower feedrates. Based on the investigation summarized below and detailed in Appendix B, we conclude that downward extrapolation of feedrates for the purpose of complying with the mercury and semivolatile metals emission standards for liquid fuel boilers will ensure compliance with the emission standards under the conditions discussed below.

We investigated the theoretical relationship between stack gas emissions and feedrate considering vapor phase metal equilibrium, the chlorine, mercury, and semivolatile metal feedrates for liquid fuel boilers in our data base, and the mercury and semivolatile emission standards for liquid fuel boilers. We considered sources equipped with dry particulate matter controls and sources equipped with wet particulate matter controls.

Sources Equipped with Dry Controls. For sources equipped with dry controls other than activated carbon, mercury is not controlled. Thus, you must assume zero system removal efficiency. Consequently, if you are in the low Btu subcategory and comply with the mercury standard expressed as a mass concentration (ug/dscm), the mercury feedrate limit expressed as an MTEC (maximum theoretical emission concentration, ug/dscm) is equivalent to the emission standard.[2] If you are in the high Btu subcategory and comply with the mercury standard expressed as a hazardous waste thermal emission concentration (lb/MM Btu), the mercury feedrate limit expressed as a hazardous waste thermal feed concentration (lb/MM Btu) is also equivalent to the emission standard.

For semivolatile metals, the theoretical relationship between emissions and feedrate indicates that downward extrapolation introduces only a trivial error—0.17% at an emission rate 100 times the standard irrespective of the level of chlorine present. Nonetheless, to ensure the error is minimal and to be practicable, you should limit semivolatile emissions during the comprehensive performance test to five times the emission standard.

Sources Equipped with Wet Scrubbers. For sources equipped with wet scrubbers, we conclude that the approach we use for semivolatile metals for dry scrubbers will also be appropriate to extrapolate a semivolatile metal feedrate limit for wet scrubbers. To ensure that downward extrapolation of the feedrate limit is conservative and to be practicable, you should limit semivolatile metal emissions during the comprehensive performance test to five times the emission standard.

For mercury, ensuring control with wet systems is more complicated because the level of chlorine present affects the formation of mercuric chloride which is soluble in water and easily controlled by wet scrubbers. Elemental mercury has very low solubility in scrubber water and is not controlled. The worst case situation for conversion of elemental mercury to soluble mercuric chloride would be when the chlorine MTEC is lowest and the mercury MTEC is highest. We conclude that downward extrapolation of mercury feedrates is conservative for feedstreams that contain virtually no chlorine, e.g., below an MTEC of 100 ug/dscm. In addition, we conclude

---

[2] Note, however, that you convert the MTEC (ug/dscm) to a mass feedrate (lb/hr) by considering the average gas flowrate of the test run averages during the comprehensive performance test to simply implementation and compliance.

that downward extrapolation is appropriate[3] for boilers feeding chlorinated feedstreams provided that during the performance test: (1) scrubber blowdown has been minimized and the scrubber water has reached steady-state levels of mercury prior to the test (e.g., by spiking the scrubber water); (2) scrubber water pH is minimized (i.e., you establish a minimum pH operating limit based on the performance test as though you were establishing a compliance parameter for the total chlorine emission standard); and (3) scrubber water temperature is maximized (i.e., you establish a maximum temperature operating limit based on the performance test as the average of the test run averages).

Compliance With Hazardous Waste Thermal Emission Standards

Several of the metal and chlorine emissions standards are based on hazardous waste thermal emissions (mass emissions of HAP in stack gas that is attributable to hazardous waste, divided by the thermal input of the hazardous waste – i.e., lb HAP / MMBtu hazardous waste feed).

HAP feed operating limits (lb HAP in hazardous waste per thermal input of hazardous waste) are determined from that used during the comprehensive performance test.

Compliance with the hazardous waste thermal input operating limit is determined by: (1) continuously monitoring hazardous waste feedrate; (2) knowing the higher heating value of hazardous waste at all times; and (3) knowing the HAP concentration in hazardous waste at all times. These parameters are used to determine the average hazardous waste HAP thermal feedrate over the appropriate averaging period (12 hours for standards based on compliance test data, one year for standards based on normal test data). The hazardous waste HAP thermal feedrate is calculated as the ratio of the total feedrate of HAP from hazardous waste over the averaging period (lb HAP) to the total thermal input provided by hazardous waste over the averaging period.

Determining Feedrate Levels from a Combination of Periodic and Continuous Measurements

Individual constituent (metals, chlorine, ash, etc.) feedrates from individual feedstreams are most typically determined from the multiplication product of two measurements: a continuous measurement of the total feedrate of the feedstream and a periodic evaluation of the constituent concentration in the feedstream. This provides a continuous determination of the constituent feedrate in each feedstream. The constituent concentration that is most representative of the feedstream is used to determine the total feedrate.

Determination of Feedstream Constituent Levels

Feedstream sampling and analysis procedures must be documented in the comprehensive performance test work plan and feedstream analysis plan (FAP).

---

3 Mercury SRE is constant as the mercury feedrate decreases.

For homogeneous waste, and waste for which characteristics are well known and well established, continuing statistical evaluation of multiple, representative measurements of the feedstream is recommended.

Alternatively, for heterogeneous wastes, wastes with limited process knowledge, and/or infrequently generated wastes, “batch” analyses may be appropriate. Sampling from each different “batch” of waste is required for effective characterization. It is critical that “representative” samples are obtained. Compositing and homogenizing multiple samples are recommended to increase accuracy and minimize sample number. Statistical analysis may be of limited use, or not appropriate, due to the inability to collect and analyze sufficient numbers of samples.

Special Feedstream Requirements

Characterization of metals or chlorine from natural gas feedstreams, process air feedstreams, and feedstreams from vapor recovery systems, is not required on an on-going basis with direct sampling and analysis. However, constituent levels in these feedstreams must be considered when determining compliance with feedrate limits. These levels must be documented and supported in the FAP. This may include information from fuel suppliers, trade organizations, limited sampling and analysis, process knowledge, etc.

Handling Nondetect Measurements When Setting Feedrate Limits[4]

Sources must document on a site-specific basis, as part of the Agency reviewed and approved comprehensive performance test work plan, procedures for accounting for nondetect feedstream measurements (taken during comprehensive performance testing) when setting feedrate operating limits. Procedures may include:

- Assuming the HAP is not present in the feedstream (zero). In this case, the total feedrate limit would need to be set based on other feedstreams where the HAP was detected.

- Assuming the HAP is present at one-half or one-quarter of the detection limit when determining the feedrate limit.

- Setting separate HAP feedrate limits at the full detection limit for each different feedstream which is nondetect.

- Considerations for selecting the nondetect handling procedure should include:

[4] This issue is different from handling nondetects in MACT standard calculations (under the SRE feed approach). Since nondetects dampen run to run variability, a statistical imputation approach was used to impute values for these nondetects within an allowable range such that the upper 99th percentile of the feed would be maximized. This UPL 99 feed was then used as one of the two components in the SRE-Feed ranking procedure which determined the pool of best performers. (see USEPA, “Technical Support Document for HWC MACT Standards: Volume III: Selection of MACT Standards,” September 2005, Sections 5.4 and 7.3 for more information). Also note that for the MACT floor calculations, if feedstreams were nondetect the test condition was not used because SRE could not be calculated.

- How close the emissions test result is to the emissions standard.

- Site specific detection limit level that is achieved.

- Method to address nondetect measurements on an on-going daily basis to comply with the feedrate limit.

There are no requirements for achieving certain detection limits (i.e., minimum allowable detection limits are not specified). This is due primarily to the difficulty in identifying a single (or multiple) detection limit that is appropriate for various feedstreams due to feedstream matrix impacts on achievable detection limits. Instead, site-specific target detection limits are to be submitted in an Agency-reviewed and approved comprehensive performance test plan and accompanying feedstream analysis plan. Evaluation of appropriate detection limit levels is based on considerations including:

- Costs associated with achieving different detection limits during subsequent, day-to-day operations; and

- Estimated maximum emissions that would be projected to be associated with the feedstream at the detection limit (considering if appropriate any likely control in the system), and comparison of this level with the emissions standard. For example, the use of higher detection limits may result in less assurance that the source is continuously complying with the emission standard.

Handling Nondetects When Complying With Feedstream Limits

When determining compliance with feedrate limits, nondetects in individual feedstreams should generally be treated as present at the full detection limit.

3.0 PCDD/PCDF

There is currently no CEMS for the direct real-time measurement of PCDD/PCDF in stack gas emissions. It will likely be some years before such a device is available due to technical issues including: (1) the large number of PCDD/PCDF congeners as well as isomers within each congener that require monitoring; (2) PCDD/PCDF are semivolatile compounds at stack temperatures (present potentially in both the gaseous vapor phase, as well as adsorbed on PM); and (3) the need for extremely low detection limits (on the order of parts per billion).

Continuous compliance for PCDD/PCDF is assured indirectly through the monitoring of system operating parameters that influence PCDD/PCDF formation and control, potentially including:

- Limiting PCDD/PCDF formation by:

  -- Maintenance of adequate combustion quality and efficiency to achieve complete burn out of organics and limitation of organic precursors available for PCDD/PCDF formation (see section 3.1).

  -- Avoiding formation from low temperature catalytic mechanisms that can occur in a temperature range of about 400 to 700°F, and can take place during combustion gas cooling and in "dry-type" particulate matter air pollution control devices. This formation involves surface catalyzed reactions where entrained particulate matter provides the reaction surfaces (see section 3.3).

  -- Control of feed constituents that are potential PCDD/PCDF formation precursors, such as PCBs, chlorobenzenes, or chlorophenols. (see section 3.3 below)

  -- Use of PCDD/PCDF formation inhibitors. Some limited demonstrations to date have indicated that these may include constituents such as sulfur or ammonia, or other proprietary formulations. (see section 3.4 below)

  -- The control of the feedrate of chlorine has been suggested to be potentially related to PCDD/PCDF control, although this suggestion has not been confirmed with full-scale operating results. (see section 3.3 below)

- Capturing and/or destroying PCDD/PCDF that have been formed:

  -- Capturing with activated carbon. Activated carbon adsorbs PCDD/PCDF vapors. Carbon can be injected into the flue gas stream and removed in a downstream PM control device. Fixed or fluidized carbon beds can also be used.

-- Capturing condensed phase PCDD/PCDF with a PM control device (including vapors adsorbed on activated carbon).

-- Destruction with catalytic oxidizers.

-- Destroying PCDD/PCDF that is contained in the combustor feedstreams. For PCDD/PCDF listed wastes (including those listed as F020, F021, F022, F023, F026, and F027, which are RCRA hazardous wastes under Part 261 because they contain high concentrations of PCDD/PCDF), there is a requirement for achieving "6 nines" destruction and removal efficiency (i.e., 99.9999% DRE).

Specific operating parameters that are required for PCDD/PCDF control are summarized in Table 3-1.

Table 3-1. PCDD/PCDF Monitoring Requirements

Control Technique	Compliance Using	Limits From	Averaging Period[3]	How Limit Is Established
Combustion Gas Temperature Quench	Continuous monitoring system (CMS) for maximum temperature at the inlet to the dry particulate matter control device, except lightweight aggregate kilns must monitor gas temperature at the kiln exit	Comprehensive performance test	1-hour	Avg of the test run averages
Good Combustion Practices	CMS for maximum waste feedrates for pumpable and total wastes for each feed system	Comprehensive performance test	1-hour	Avg of the maximum hourly rolling averages for each run
	CMS for minimum gas temperature for each combustion chamber	Comprehensive performance test	1-hour	Avg of the test run averages
	CMS for maximum gas flowrate or kiln production rate	Comprehensive performance test	1-hour	Avg of the maximum hourly rolling averages for each run
	Monitoring of parameters recommended by the source to maintain operation of each hazardous waste firing system[1]	Based on source recommendation	To be determined case-by-case	To be determined case-by-case
Activated Carbon Injection[2]	Good particulate matter control: Monitoring requirements are the same as required for compliance assurance with the particulate matter standard. See Section 4.			
	CMS for minimum carbon feedrate	Comprehensive performance test	1-hour	Avg of the test run averages
	CMS for minimum carrier fluid flowrate or nozzle pressure drop	Manufacturer specifications	1-hour	As specified

Control Technique	Compliance Using	Limits From	Averaging Period[3]	How Limit Is Established
	Identification of carbon brand and type or adsorption properties	Comprehensive performance test	n/a	Same properties based on manufacturer's specifications

Activated Carbon Bed[2]	Good particulate matter control: Monitoring requirements are the same as required for compliance assurance with the particulate matter standard. See Section 4.			
	Determination of maximum age of each carbon bed segment	Site-specific	Site-specific	Site-specific
	Identification of carbon brand and type or adsorption properties	Comprehensive performance test	n/a	Same properties based on manufacturer's specifications
	CMS for maximum gas temperature at the inlet or exit of the bed	Comprehensive performance test	1-hour	Avg of the test run averages
Catalytic Oxidizer[2]	CMS for minimum gas temperature at inlet to catalyst	Comprehensive performance test	1-hour	Avg of the test run averages
	Identification of maximum catalyst time in-use	Manufacturer specifications	As specified	
	Identification of catalytic metal loading	Comprehensive performance test	n/a	Same as used during comprehensive test
	Identification of maximum space-time for the catalyst			
	Identification of substrate construct: materials, pore size			
	CMS for maximum flue gas temperature at inlet to catalyst	Manufacturer specifications	1-hour	As specified

Dioxin/Furan Formation Inhibitor[2]	CMS for minimum inhibitor feedrate	Comprehensive performance test	1-hour	Avg of the test run averages
	Identification of inhibitor brand and type or inhibitor properties	Comprehensive performance test	n/a	Same properties based on manufacturer's specifications

[1] You must recommend operating parameters, monitoring approaches, and limits in the comprehensive performance test plan to maintain operation of each hazardous waste firing system.

[2] A CMS for gas flowrate or kiln production rate is also required with the same provisions as required for those parameters under the Good Combustion Practices control technique.

[3] All averaging periods are not-to-exceed values.

3.1 Combustion Efficiency

For PCDD/PCDF control, maintaining combustion efficiency and quality involves complete burn-out of organics and limitation of the formation of PCDD/PCDF precursors such as chlorinated or non-chlorinated aromatic compounds (e.g., phenol, benzene), as well as aliphatics. A variety of parameters may be considered as indicators for maintaining combustion efficiency, including: (1) flue gas CO and HC concentration [5](2) flue gas flowrate; (3) waste feedrate; (4) temperature in combustion chamber(s); (5) waste batch size and feeding frequency; (6) combustion chamber oxygen level; (7) hazardous waste firing system parameters (e.g., liquid burner settings and solid waste feed procedures); (8) feed composition variations; (9) combustion air mixing and distribution; and (10) flue gas PIC content.

The following briefly discusses the rationale for the selection of appropriate limits. Specific monitoring requirements, averaging periods, limit setting bases, etc. are discussed in the Section 9 (DRE compliance).

- CO and HC -- MACT standards for flue gas CO and HC levels are used to ensure combustion efficiency is being maintained on a continuous basis. CO and HC flue gas levels are direct indicators of combustion efficiency.

- Flue gas flowrate (or production rate) -- A maximum limit on flue gas flowrate is required as a direct measure of the combustion gas velocity through the combustion chamber(s). It is limited to ensure:

[5] This is generally the most important parameters.

-- Flue gas residence times are sufficient to result in adequate flue gas "time at temperature" to assure compliance with the DRE standard and to minimize organic HAP emissions.
-- Back pressure at system joints and seals (e.g., at the junction between a rotary kiln and afterburner) is not so high that it results in combustion system leaks.
-- Gas flowrate through the air pollution control equipment is not so high it results in the system being overloaded, which may cause the emissions standards to be exceeded.

- Waste feedrate -- A maximum limit is required to avoid overcharging the waste combustion chamber. Overcharging may lead to incomplete combustion of feed organics and release of unburned material containing PCDD/PCDF or PCDD/PCDF precursors. For incinerators, waste stream feedrate limits are established for each combustion chamber (and each waste feed location) to minimize combustion perturbations. For industrial kilns, individual waste stream feedrate limits are set for each location where waste is fed (e.g., the hot end, mid-kiln, or the cold end where raw material is fed). Also, limits are set on both pumpable and non-pumpable wastes.

- Combustion chamber temperature -- A limit on minimum temperature in combustion chamber(s) is required. Sufficient temperature is needed to destroy organic waste constituents. Generally, the higher the temperature, the greater the level of destruction of organics because the reaction rate for the destruction of organics compounds and the oxidation of their products of incomplete combustion increases with temperature. For incinerators, limits are required for each incinerator chamber (for example, separate limits for combustors with primary and secondary (afterburner) chambers). For cement and lightweight aggregate kilns, limits are required at each of the waste feed locations. For kilns which feed waste at mid-kiln locations, measurement of kiln back-end temperature may be requested as a surrogate to direct monitoring of mid-kiln temperature.

  Limits are required for each combustion chamber regardless of whether waste is fed into the chamber. Combustion temperature measurement location(s) are identified in the comprehensive performance test plan, and are subject to EPA approval on a site-specific basis.

- Batch feeding units -- As discussed in the Sections 8 and 9 (CO/HC and DRE compliance), batch feeding limits are not required in general. However, certain batch feeding units may be required on a site-specific basis, as a preventative measure for assuring proper combustion, to establish and comply with a variety of limits on batch feed operating parameters (e.g., batch size, composition, waste volatility, and/or heating content, feeding frequency, oxygen level, etc.). These are used to ensure efficient combustion is being maintained (e.g., minimize oxygen deficiencies, combustor "puffing", and flame quenching). The determination for the requirement of limits on these operating parameters will be based on a variety of site-specific considerations, including past facility operational performance, number of automatic waste feed cutoffs, facility design and operation, etc.

Comprehensive performance testing must be conducted under simulated "worst-case" batch feeding operating conditions, regardless if the source establishes batch feed operating parameter limits. This should consider the types and quantities of wastes that may be burned, and the range of batch feeding related operating parameters that are expected during subsequent on-going post-test operations.

- Combustion chamber oxygen level -- Also as discussed in Sections 8 and 9 (CO/HC and DRE compliance), a limit on oxygen is not required for all facilities in general. However, for batch feeding systems, a limit on combustor oxygen level may be required on a site-specific basis, as a preventative measure for assuring proper combustion. An oxygen limit may help prevent combustion perturbations.

  Both insufficient and excess oxygen levels may lead to increased PCDD/PCDF emissions. Insufficient oxygen results in the formation of PICs which may be PCDD/PCDF precursors; however, insufficient oxygen levels are indicated by high CO and HC flue gas levels, which are required to be continuously monitored. Alternatively, high excess oxygen levels may act to cool the combustion zone, allowing for organics to escape undestroyed. The HC limit should serve as a safeguard against this failure mode. It may not be desirable to operate at high excess oxygen levels since an increase in available oxygen has been shown to increase PCDD/PCDF emissions.

  Other reasons for not generally requiring an oxygen limit include:

  -- Difficulty in picking one excess oxygen level that is satisfactory for the combustion of different waste types.

  -- Concern about continuously and reliably measuring oxygen concentration at the combustion chamber exit. Measurements are normally made at the stack, where air leakage in between the combustion chamber and the measurement probe location can mask deficiencies in the combustion chamber thus limiting the value of the measurements.

  -- Several types of combustion chambers are designed to operate at sub-stoichiometric conditions (pyrolytic or gasification systems), where additional oxygen is provided in downstream combustion equipment. For these systems, a minimum oxygen level for the sub-stoichiometric chambers would be inappropriate.

  Although a minimum oxygen level operating limit is not generally required, stack gas oxygen continuous measurement is required to correct other continuous stack gas measurements (e.g., CO, HC, PM) to a common 7% O_2 standard basis.

- <u>Operation of hazardous waste firing system</u> -- Limits on parameters to ensure that the hazardous waste firing system is operating properly are to be identified in the comprehensive performance test plan, and are subject to EPA approval on a site-specific basis. These parameters may include for example, for liquid waste burners, waste burner operating parameters which can ensure adequate liquid waste atomization and efficient waste/fuel/air mixing -- and may include such parameters as atomization fluid pressure, waste heating value, liquid waste viscosity, liquid waste solids content, and burner turndown ratio.

- <u>Waste and fuel feed composition variations</u> -- Changes in combustor feed composition may adversely affect combustor operational efficiency. For example, a limit on the minimum waste heating value may be appropriate. Spikes and drops in feed compositions may result in regions of cold and/or oxygen deficient gases. However, no limit on waste heating value (or any other feed composition constituent that may affect combustion efficiency) is required because other limits discussed above suffice for ensuring adequate combustion control.

- <u>Air mixing and distribution</u> -- Inadequate mixing between combustion air and waste may lead to oxygen deficient regions and conditions of insufficient residence time at temperature for complete organics burnout. Parameters discussed above adequately ensure combustion quality. Also, certain limits on hazardous waste firing system operating parameters may help ensure proper mixing. Additionally, note that monitoring techniques for parameters that are indicative of air/fuel/waste mixing are not available or demonstrated for full-scale combustors.

- <u>PIC (Products of Incomplete Combustion) monitoring</u> -- Continuous monitoring and control of certain products of incomplete combustion may provide further assurance of good combustion practices and control of PCDD/PCDF emissions. However, due to the lack of comprehensive PIC data to set MACT PIC limits, and the current lack of demonstration of PIC CEMS, limits on CO or HC are used as direct indicators of combustion efficiency which in turn impedes PIC formation.

3.2 Low Temperature Catalytic Formation

PCDD/PCDF can be formed through a low-temperature catalytic formation process, typically occurring as the combustion gas is cooled and/or passed through a "dry" PM control device. Formation due to this mechanism has been shown to be attributable to factors including: (1) combustion gas quenching rate (gas temperature and residence time profile); (2) PM control device temperature; and (3) composition of the entrained PM, in particular its catalytic metals content.

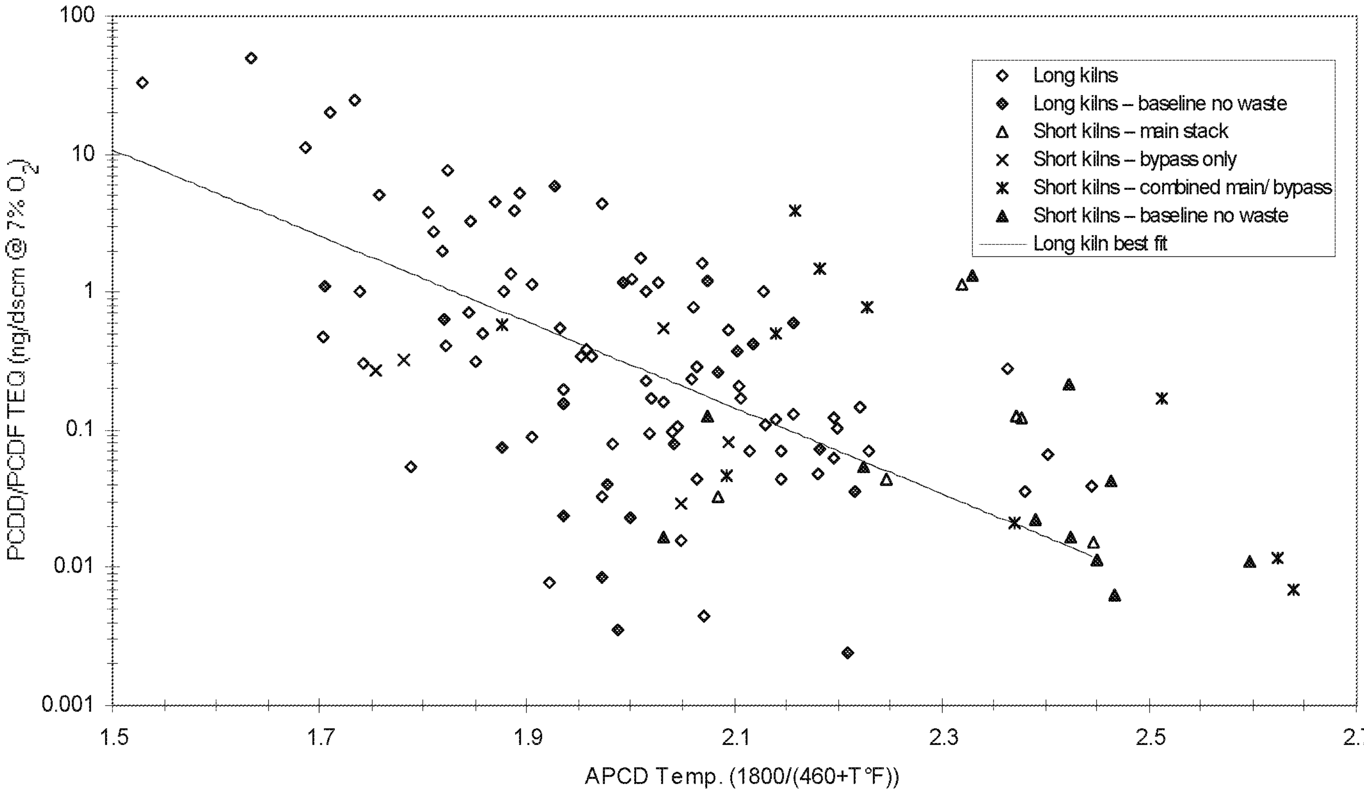
<u>Gas temperature at the inlet of dry PM APCD</u> -- A limit on maximum gas temperature at the inlet of "dry" PM APCDs is required. "Dry" PM ACPDs include ESPs and FFs, which typically operate at temperatures from 300 to 500°F, and at a minimum, levels well above the flue gas dew point (which typically ranges from 120 to 200°F). This limit is not generally

applicable to certain dry PM devices such as cyclones and other inertial type collectors where the PM is not suspended in the gas stream for great lengths of time, making the formation of PCDD/PCDF not as likely in these devices compared with FFs and ESPs. Determination of the requirement for maximum temperature limits on these other types of dry PM control devices is made on a site-specific basis depending on gas residence time in the control device, nature of the particulate hold up in the device, operating temperature, etc.

Additionally, for lightweight aggregate kilns (and other units which may have extensive ducting where the flue gas is in a temperature range of 400 to 800°F), it is required to monitor and control the gas temperature near the kiln exit after gas cooling (as opposed to the inlet to the dry APCD). This is to ensure the prevention of PCDD/PCDF formation in the flue gas transfer ducting between the kiln exit and the PM APCD. If for some reason, it is not practicable to monitor temperature at the kiln exit, a petition can be made under Section 63.1209 for an alternative monitoring location.

Rationale -- The flue gas temperature profile, in particular that through the PCDD/PCDF temperature formation region, is critical to PCDD/PCDF control. PCDD/PCDF has been shown to form when entrained PM and combustion gases are in a temperature range of from 400 to 750°F (with maximum formation occurring around 570EF). Figures 3-1 through 3-6 show examples of the relationship between PCDD/PCDF emissions and dry PM APCD operating temperature for various waste combustor types. The relationship is clearly exponential, (as noted in the Section 2 discussion of averaging times) where PCDD/PCDF emissions generally tend to increase by a factor of 10 for approximately every 120 to 150°F increase in APCD operating temperature.

Figure 3-1. PCDD/PCDF TEQ emissions as function pf APCD temperature for all cement kilns. (Source: CCoC and emissions testing results from cement kilns, conatained in the EPA/OSW Hazardous Waste Combustor Database).



2,3,7,8-TCDD TEQ (ng/dscm @ 7%

Incineration Conference, Savannah, GA, May 6-10, 1996, pp. 587-593).

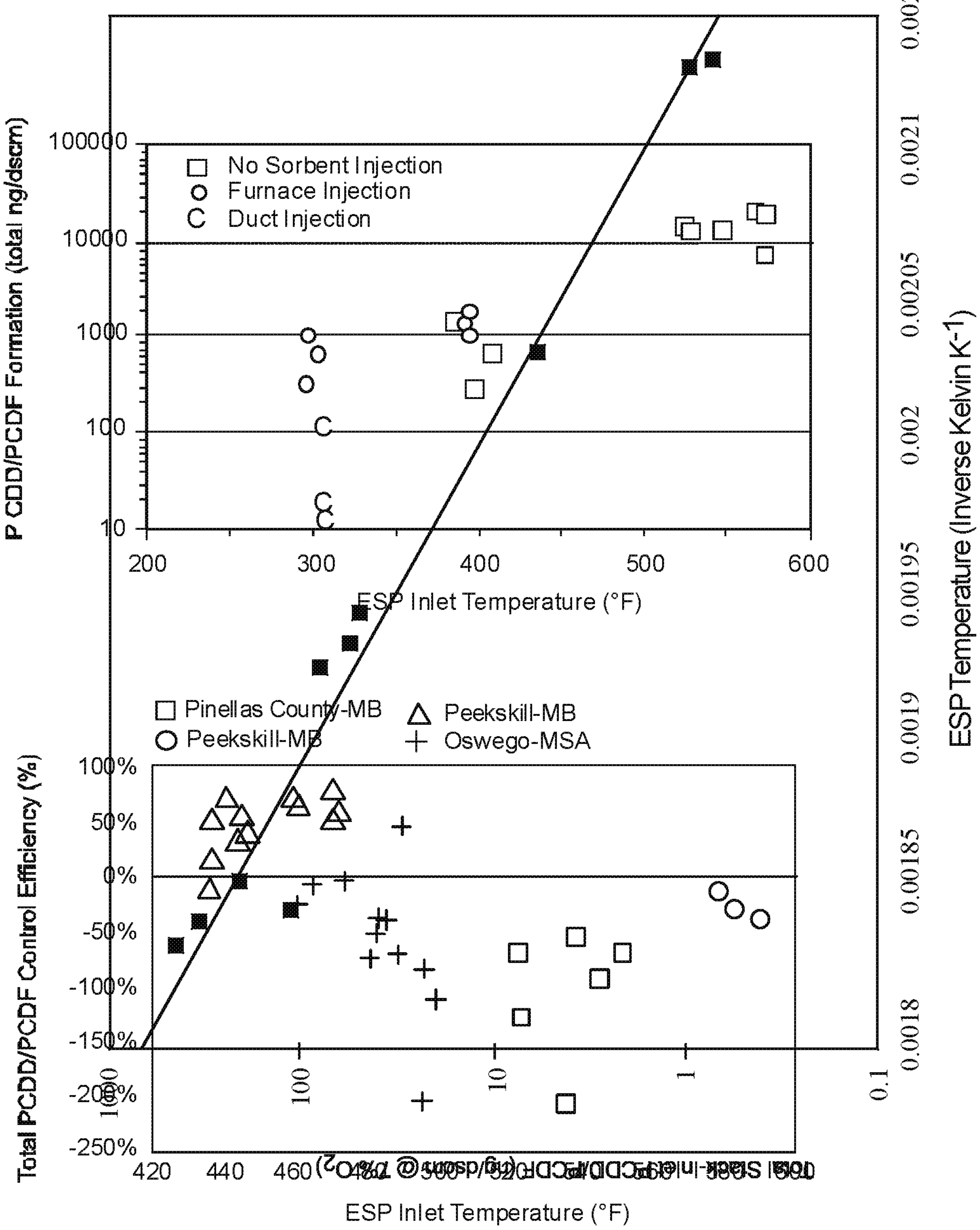


Figure 3-4. PCDD/PCDF behavior as a function of ESP inlet temperature for

Figure 3-2. PCDD/PCDF formation across the air pollution control device temperature for a hazardous waste burning cement kiln. (Source: W.S. Lanier, F.M. Stevens, B.R. Springsteen, and W.R. Seeker, "Dioxin Compliance Strategies for the HWC MACT Standards," *Proceedings of the1996 Incineration Conference*, Savannah, GA, May 6-10, 1996, pp. 587-593).

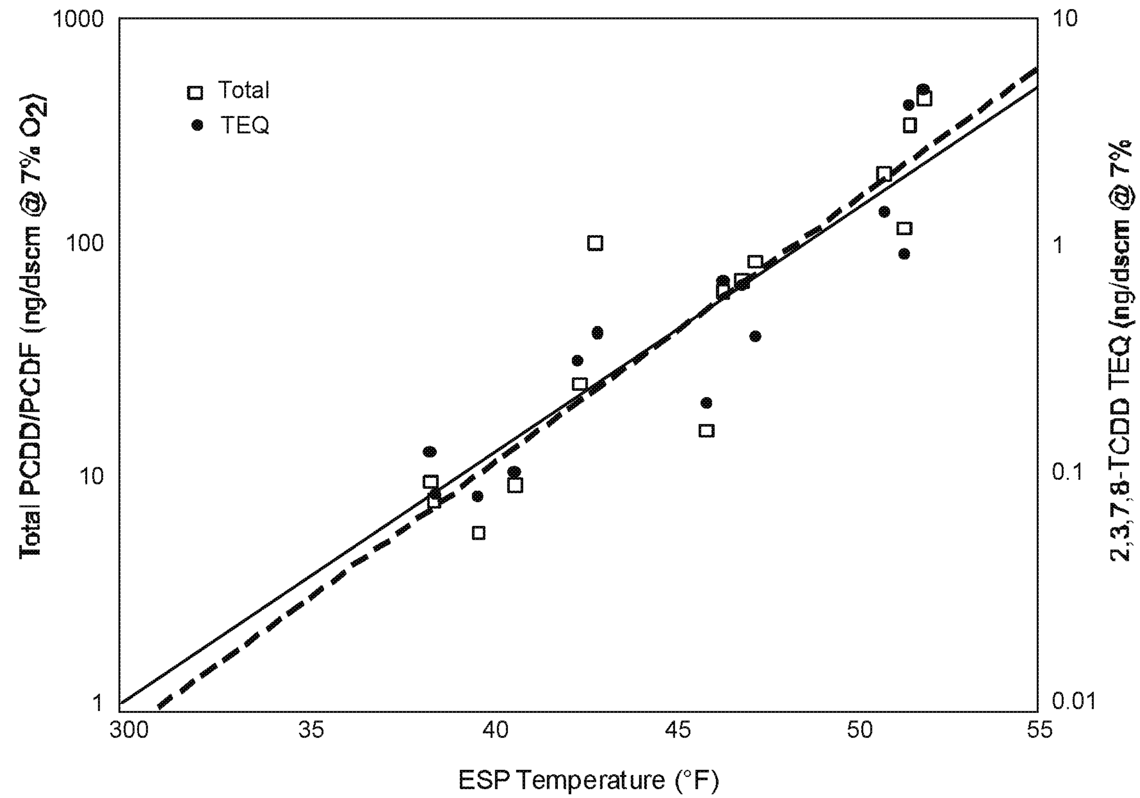
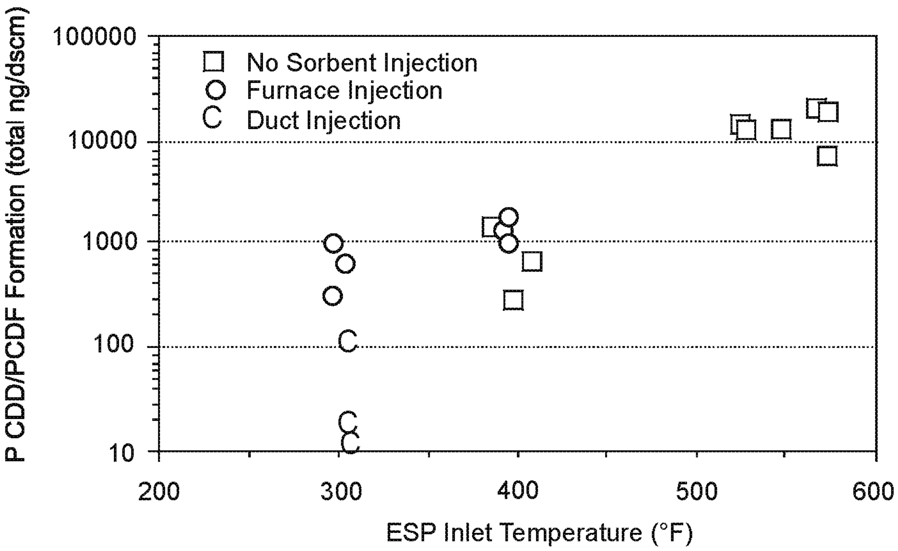


Figure 3-3. PCDD/PCDF stack gas emissions as a function of air pollution control device (ESP) temperature for a hazardous waste burning cement kiln. (Source: W.S. Lanier, F.M. Stevens, B.R. Springsteen, and W.R. Seeker, "Dioxin Compliance Strategies for the HWC MACT Standards," *Proceedings of the 1996 Incineration Conference*, Savannah, GA, May 6-10, 1996, pp. 587-593).



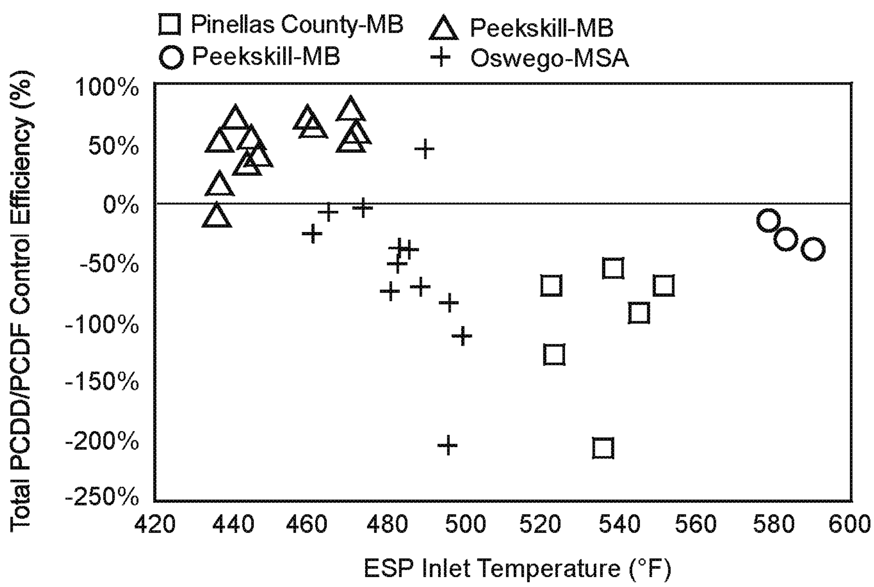
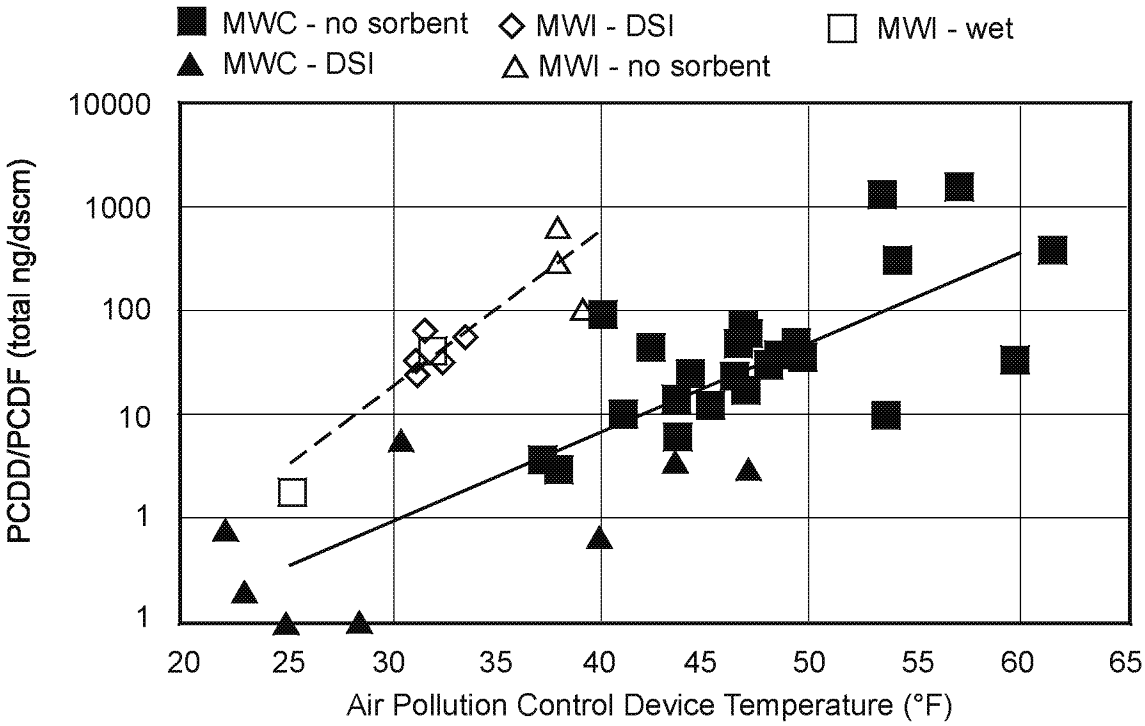


Figure 3-4. PCDD/PCDF behavior as a function of ESP inlet temperature for Municipal Waste Combustors. (Source: J.D. Kilgroe and T.G. Brna, "Control of PCDD/PCDF Emissions from Municipal Waste Combustion Systems," *Chemosphere*, Vol. 20, No. 10-12, pp. 1875-1882, 1990).



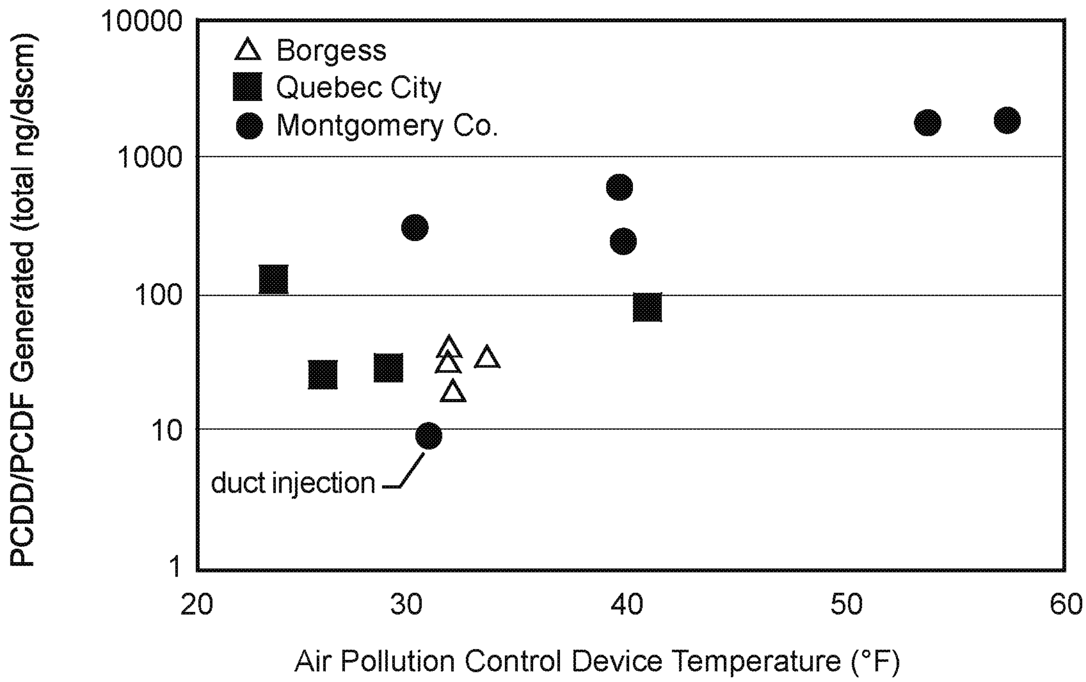


Figure 3-5. PCDD/PCDF behavior as function of air pollution control device temperature for MWI and MWCs. (Source: W.S. Lanier and T.R. von Alten, "Investigation into the Discrepency between MWI and MWC CDD/CDF Emissions," *Proceedings of the 1992 Incineration Conference*, Albuquerque, NM, May 11-15,

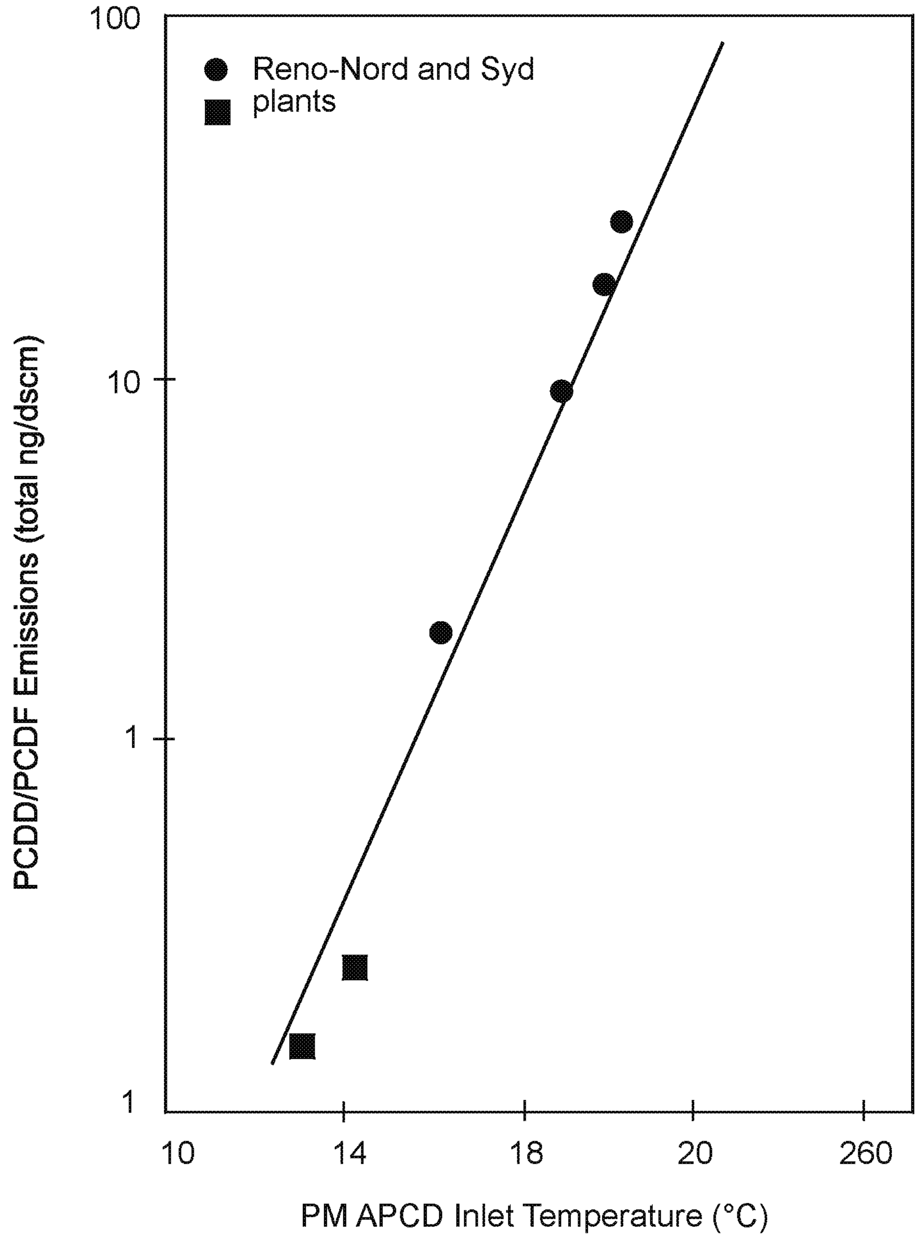


Figure 3-6. PCDD/PCDF behavior as a function of PM air pollution control device inlet temperature for MWCs. (Source: V. Boscak and G. Kotynek, "Techniques for Dioxin Emission Control," *2nd Annual International Specialty Conference on Municipal Waste Combustion*, Air and Waste Management Association, pp. 383-398, Tampa, FL, April 15-19, 1991).

Additionally, the residence time in the temperature window is important. The use of rapid quenching generally minimizes formation, whereas slower cooling may result in substantial PCDD/PCDF formation. Particle gas residence times of less than 5 seconds have been shown to be adequate for PCDD/PCDF formation, as discussed below.

Thus, to control PCDD/PCDF formation, it is desired to maintain the combustion gas temperature quenching rate and profile similar to or "faster" than that used in the comprehensive performance testing (specifically the residence time at temperatures in the downstream gas transfer ducting and air pollution control equipment). A maximum limit on the gas temperature at the inlet of a "dry" air pollution control device is generally used to ensure avoidance of operating at temperatures in the ducting and air pollution control system (downstream of the combustion chamber) above that demonstrated in the comprehensive performance tests (where the higher temperatures would potentially be conducive to PCDD/PCDF formation). The use of a limit on the inlet temperature of dry APCDs assumes that the combustion gas temperature and flue gas cooling system operates in everyday operation in a similar manner to that used in the comprehensive performance test, i.e., during other operations, the flue gas profile is comparable to that of the performance testing.

For certain LWAKs as mentioned both above and below, the limit is applied to the temperature at the kiln exit (as opposed to the inlet of the dry APCD) because some LWAKs have long flue gas transfer ducts between the kiln exit and the FF, where the flue gas is slowly cooled through the PCDD/PCDF formation temperature range.

Temperature limits to control PCDD/PCDF are not required for wet scrubber air pollution control devices. Wet scrubbers must by design operate at stack gas dew point temperatures, which typically range from 150 to 200°F. Thus, a temperature limit on the wet scrubbing device(s) is not necessary because the gas is not "held-up" in the PCDD/PCDF formation temperature range in the wet scrubber:

- Many facilities use rapid quenching of combustion gases to wet scrubber temperatures of less than 200°F (i.e., gas is cooled quickly through the temperature range of about 400 to 750°F).
- In other cases where wet scrubbing systems are used downstream of "dry" PM control devices, the flue gas exiting the dry PM control device is typically rapidly quenched to the wet scrubbing operating temperature.

Additionally, as discussed above, for units which use "slow" gas cooling, such as those using boilers or heat exchangers, and/or cooling through long flue gas transfer ducts (such as certain lightweight aggregate kilns), additional limits on maximum intermediate location temperatures upstream of the dry PM APCD may be required on a site-specific basis, such as the temperature prior to and/or immediately after cooling locations.

Limit compliance period -- The maximum temperature limit is complied with on a (not-to-exceed) 1-hour rolling average basis.

Note that the strong, non-linear relationship between "dry" PM air pollution control device temperature and PCDD/PCDF emissions is based on emissions testing data from EPA Manual Sampling Method 23. Method 23 is an integrated measurement over a 2 to 4 hour duration. However, this relationship remains valid over shorter time durations (e.g., 1 hour). Specifically, the low temperature catalytic PCDD/PCDF formation reactions, which are the basis for the limit on PM APCD operating temperature, have been shown to be rapid (i.e., on the order of seconds, as opposed to minutes or hours):

- In recent testing at a hazardous waste burning LWAK, PCDD/PCDF formation was observed in an uninsulated transfer duct between the kiln exit and the fabric filter, with a gas residence time in the transfer duct of about 6 seconds. In the first series of testing, the gas temperature was 600EF at the kiln exit and 390EF at the fabric filter. PCDD/PCDF levels of about 2 ng TEQ/dscm were measured. In the second series of testing, the kiln exit gases were quenched rapidly to about 450EF, with a similar fabric filter temperature as in the first series. PCDD/PCDF levels were reduced to 0.5 ng TEQ/dscm.

- Various pilot scale combustor research studies have shown PCDD/PCDF formation rates with gas phase residence times of as little as 2 to 5 seconds in the post-combustion low temperature catalytic formation range (of about 400 to 700EF). These formation rates are sufficient to explain full scale stack gas PCDD/PCDF levels.

Thus, the use of a 1-hour rolling average period for compliance with the dry PM APCD temperature limit is appropriate and necessary to better ensure compliance with the PCDD/PCDF standard. In some site specific cases, it may further be determined that shorter averaging periods are appropriate.

Limit basis -- The limit is set based on that demonstrated during the comprehensive performance tests. The 1-hour rolling average limit is set based on the average of the individual run averages (for each pertinent run of the comprehensive performance test).

Measurement techniques -- Flue gas temperature is measured with similar techniques discussed in Section 9 (DRE compliance) for combustion gas temperature (e.g., thermocouples).

<u>Feed restriction on catalytic constituents (e.g., metals)</u> -- Copper, as well as iron and nickel, have been suggested to be responsible for the catalytic reactions that lead to PCDD/PCDF formation. However, an operating limit on maximum feedrate of these constituents is not required because: (1) the presence of these metals is difficult to control due to their common nature and occurrence; (2) recent EPA monitored tests on a cement kiln with an ESP have shown that there is no apparent correlation between PCDD/PCDF and copper feedrates; and (3) there may be other unknown constituents that are also important to PCDD/PCDF formation, so as a practical matter only limiting these three metals may not result in the control of PCDD/PCDF emissions.

3.3 Waste Characteristics

Waste precursor content -- Certain PCDD/PCDF formation precursors (such as chlorophenols, chlorobenzenes, or chlorinated biphenyls, and other compounds which closely resemble the PCDD/PCDF structure) are suspected to be responsible for high PCDD/PCDF stack gas emissions in some cases. However, other factors such as dry PM control device temperature and overall combustion efficiency are typically more important to PCDD/PCDF formation. Additionally, the measurement of all suspected PCDD/PCDF precursor compounds may not be feasible. Thus a requirement for the limitation of potential PCDD/PCDF precursors in combustor feedstreams on a semi-continuous basis is not required.

Note that hazardous waste analysis for various organics is required (as part of the reviewed and approved waste (feedstream) analysis plan) for determining compliance with site-specific waste acceptance criteria. For example, analysis of waste organics to ensure that Principal Organic Hazardous Constituents used in the performance testing are representative. These criteria are used for determining and assuring the proper acceptance and appropriateness of wastes for thermal treatment, and are set based on site-specific considerations.

Also, the comprehensive performance and confirmatory compliance testing should be conducted using feedstreams that are fully representative with respect to their content of likely PCDD/PCDF precursors based on knowledge of the composition of the wastes streams that are to be burned (i.e., have similar or higher levels of PCDD/PCDF precursors in the compliance tests than expected in subsequent on-going operations).

Chlorine feedrate -- Limited bench-scale studies have shown a direct relationship between waste chlorine content (and resulting HCl and Cl_2 flue gas emission levels) and PCDD/PCDF stack gas emissions levels – especially for units where flue gas cooling is slow enough to allow the formation of Cl_2, which is a very strong chlorination agent (e.g., units with waste heat boilers).

However, many evaluations on full scale combustion equipment suggest that there is no clear relationship[6]. Suggestions as to why there is no apparent strong relationship between chlorine feed and PCDD/PCDF levels include:

- The requirement of extremely low levels of chlorine for PCDD/PCDF formation (demonstrated by the detection of PCDD/PCDF emissions from the combustion of relatively chlorine free diesel and distillate oils);

6 For example, see Rigo, Chandler, and Lanier, 1995, "Relationship between Chlorine in Waste Streams and Dioxin Emissions from Waste Combustor Stacks" ASME Report, ASME Order #: I00385, ISBN #: 0791812227

- The more dominant influence of other parameters such as PM air pollution control device operating temperature or combustion efficicency on PCDD/PCDF emissions levels; and

- PCDD/PCDF formation has been shown to be sensitive to the chlorine content of the fly ash, and alternatively not very sensitive to the HCl content of the flue gas. Chlorine saturation in the fly ash occurs at low levels of chlorine feed. At higher chlorine feed levels, the HCl gas content increases proportionally, with no effect on the fly ash chlorine content. Thus PCDD/PCDF formation is not significantly impacted by higher chlorine levels.

Note that PCDD/PCDF can be formed when burning very low chlorine-containing wastes. PCDD/PCDF have been detected when burning chlorine-free distillate oil and diesel gasoline. Chlorine contained in the combustion air has been attributed to PCDD/PCDF formation. Inland ambient air can contain 1 to 10 ppb chlorine. The chlorine content of air near the ocean can approach 1 ppm. Thus, ambient air may have from 100 to 100,000 times more chlorine than is theoretically needed to form PCDD/PCDF at a PCDD/PCDF level of 20 ng/dscm (total PCDD/PCDF, not TEQ).

Thus, a limit on the maximum chlorine feedrate is not required for compliance with PCDD/PCDF limits. However, note that a maximum feed rate limit for chlorine is required based on limiting of metals volatility and chlorine emissions, as discussed below in more detail, if both total chlorine and LVM and SVM continuous emissions monitors are not used (or chlorine and metals low feedrate waivers are not used).

Also, waste with normal "average" (or greater) levels of chlorine must be used during the confirmatory performance tests.

3.4 Formation Inhibitors

Certain compounds have been demonstrated to inhibit PCDD/PCDF formation. These include sulfur, nitrogenated compounds such as ammonia, and other proprietary mixtures. The inhibitors may function as both a catalyst poison for the low temperature catalytic formation reaction, and also to eliminate PCDD/PCDF precursors that form prior to the catalytic temperature range. Inhibitor parameters affecting performance include inhibitor feedrate and inhibitor specifications.

Feedrate limits are not set for inhibitors occurring "naturally" in process raw materials, auxiliary fuels, waste and/or any other feedstreams, such as sulfur in coal used in cement and lightweight aggregate kilns, fuel oil used in incinerators, etc[7]. Limits are set only on inhibitors specifically added for the clearly intended purpose of PCDD/PCDF control.

[7] See, USEPA, "Technical Support Document for HWC MACT Standards, Vol III: Selection of MACT Standards," September 2005, Section 14.2 for why minimum sulfur levels are not being required for solid fuel boilers.

Inhibitor injection feedrate -- A limit on the minimum inhibitor injection feedrate is required.

Rationale -- Inhibitor performance improves with increased inhibitor feedrate.

Limit compliance period -- The limit is complied with on a (not-to-exceed) 1-hour rolling average period.

Limit basis -- The limit is set based on comprehensive performance test demonstrations. The 1-hour limit is based on the average of the individual run averages (for each different test run).

Measurement technique -- Inhibitor feedrates can be measured with techniques discussed in Section 9 (DRE compliance) for waste feedrate. These may include solid and/or liquid phase measurement techniques.

Inhibitor specifications -- Inhibitor specifications such as chemical (specific chemical constituents in the inhibitor) and physical (atomization quality, grain size, etc.) properties can affect performance. Thus, the inhibitor that is used in continuing everyday operations must be shown to have similar or superior performance characteristics compared with that used in the comprehensive performance test.

One compliance option is to limit the brand and type of inhibitor used during everyday operations to exactly what was used in the comprehensive compliance testing.

Alternatively, it may be desired to have flexibility in using different brands and/or types of inhibitors in everyday operation compared with that used in the comprehensive compliance testing. If this is required, the comprehensive performance test plan must document appropriate performance characteristics of the inhibitor that is used in the performance test. These proposed characteristics will be reviewed and approved as part of the comprehensive performance test work plan approval by the appropriate agencies. These characteristics will be used as the basis for inhibitor-type changes. The source must document in the written operating record that the inhibitor that is being used is adequate (i.e., that it meets the specifications of that used in the compliance testing). For inhibitors that are significantly different from that used in the performance testing (such as inhibitors from a new source or vendor), limited retesting and/or information submittals to demonstrate the performance capabilities of the new inhibitor may be needed. Note that these requirements are similar to those for carbon adsorption systems and caustic injection from dry scrubbers, discussed in Sections 5 and 7.

3.5 Air Pollution Control Devices

3.5.1 PM Control Devices

By themselves, PM control devices may have limited PCDD/PCDF control effectiveness for many hazardous waste combustors. At the low concentrations of concern, PCDD/PCDF is generally primarily in vapor form rather than condensed at PM control device temperatures. However, PM control may be effective for units where PCDD/PCDF is adsorbed onto particles containing unburned carbon. It will certainly be of critical importance for facilities which rely on activated carbon (either in beds or injection) for PCDD/PCDF control, such as facilities with waste heat boilers. Thus all PM control devices discussed in the PM compliance section also may be applicable to PCDD/PCDF control. Note that wet scrubbers may not be effective for PCDD/PCDF vapor control because PCDD/PCDF is not generally considered to be soluble in water.

3.5.2 Carbon Injection

Carbon injection may be used for PCDD/PCDF control. Effectiveness is determined by parameters including carbon injection rate, carbon type and specifications, carbon-to-gas mixing, carbon reuse rate, and carbon injection temperature.

<u>Carbon feedrate</u> -- A limit on the minimum carbon injection rate is required.

Rationale -- Increased rates of carbon injection lead to increased levels of PCDD/PCDF control.

Limit compliance period -- The minimum limit is complied with on a (not-to-exceed) 1-hour rolling average period.

Limit basis -- The limit is set based on comprehensive performance test demonstrations. The 1-hour limit is based on the average of the individual run averages (from each pertinent test run of the comprehensive performance testing).

Measurement technique -- Carbon feedrate can be monitored with techniques similar to those discussed in the DRE compliance section for solid waste feedrate monitoring. These may include volumetric methods such as screw or belt conveyor feeders; or hopper weight load cell or level indicators.

<u>Carbon type and specifications</u> -- Activated carbon specifications such as the chemical and physical properties can affect performance. Important physical properties can include: specific surface area (as measured with BET (Brunauer-Emmett-Teller) test), pore volume,

average pore size, pore size distribution, bulk density, porosity, median particle size, etc. Chemical properties can include: carbon source (bituminous coal, lignite coal, wood), impregnation procedure (typically with sulfur or iodine), carbon composition of sulfur, iodine, chlorine, and/or bromine content, activation procedure (chemical vs. steam vs. thermal), etc.

Thus, the carbon that is used in continuing everyday operations (beyond the comprehensive performance testing) must be shown to have similar or superior performance characteristics compared with that used in the comprehensive performance test.

One compliance option is to limit the brand and type of carbon that is used during everyday operations to exactly what was used in the comprehensive compliance testing.

Alternatively, it may be desired to have flexibility in using different brands and/or types of carbons in everyday operation compared with that used in comprehensive compliance testing. If this is desired, the comprehensive performance test plan must document the important performance characteristics of the carbon that is used in the performance test. These proposed characteristics will be reviewed and approved as part of the comprehensive performance test plan approval by the appropriate Agencies. These characteristics will be used as the basis for carbon-type changes. The source must document in the written operating record that the carbon that is being used in on-going operations is adequate (i.e., that it meets the specifications of that used in the compliance testing). For carbons that are significantly different from that used in the performance testing (such as carbon from a new source or vendor), limited retesting and/or information submittals to demonstrate the performance capabilities of the new carbon is suggested. These requirements are similar to that discussed for inhibitor systems above, and caustic injection from dry scrubbers in Section 7 (chlorine compliance).

Carrier gas flowrate or injection system nozzle pressure drop -- A limit on minimum carbon carrier flowrate is required. Injection nozzle pressure drop may also be used as an indicator of carrier flowrate.

Rationale -- The minimum carrier gas flowrate is needed to ensure that the injected carbon particles are properly fluidized in the pneumatic transfer lines so that they do not agglomerate prior to injection, and to ensure adequate flue gas duct coverage and carbon penetration into the flue gas. Nozzle pressure drop can also be used as a direct indicator of carbon penetration.

Limit compliance period -- The limit is complied with on a (not-to-exceed) 1-hour rolling average period.

Limit basis -- The limit is set based on equipment manufacturer and/or designer specifications. Rationale for the limit is to be included in the performance test plan submitted for Agency review and approval.

Measurement techniques -- Carrier gas flowrate can be measured using techniques such as pitot tube, rotameter, or flow constrictor (similar to those discussed in Section 9). Nozzle pressure drop can be measured with pressure taps.

Carbon recycling rate -- In some cases, all or a portion of the injected carbon that is captured in the PM control device may be reused (i.e., reinjected back into the duct for additional PCDD/PCDF capture if the carbon is not saturated). If carbon recycling is used, a maximum limit on the recycling rate may be appropriate on a site-specific basis.

Flue gas temperature -- Carbon PCDD/PCDF capture efficiency tends to increase with decreasing flue gas temperature. Thus a maximum flue gas temperature limit is appropriate. The maximum air pollution control device temperature limit requirement for controlling PCDD/PCDF catalytic formation discussed above is sufficient for assuring that proper temperature is maintained at the carbon injection location.

3.5.3 Carbon Bed

Carbon beds may be used for PCDD/PCDF control. Effectiveness is determined by parameters including flue gas flowrate, bed age, and flue gas temperature.

Flue gas flowrate -- To ensure adequate flue gas residence time in the carbon bed, a limit on maximum flue gas flowrate is required. Limit compliance period, basis, and measurement methods are discussed in Section 9.

Carbon type and specifications -- Requirements identical to those discussed above for carbon injection are also applicable to carbon beds.

Age of Bed -- On a site-specific basis, operating and monitoring parameters for ensuring the bed has not reached the end of it's useful life to minimize PCDD/PCDF emissions at least to HWC MACT standards levels must be included in the Agency reviewed and approved comprehensive performance test work plan. The operating scheme must be documented in the operating and maintenance plan. Operating requirements (including when bed or bed segments are replaced) must be recorded in the operating record. Monitoring parameters must be consistent with those specified by the carbon bed manufacturer.

Rationale -- Bed monitoring is required to ensure that the bed does not become poisoned or saturated with adsorbed flue gas constituents, resulting in a reduction of control effectiveness. Adsorption capacity and capability of the carbon bed must be maintained at an equal or greater level than that used in the comprehensive performance test burn.

Limit basis -- Parameters used to monitor carbon bed age and carbon bed performance are to be included on a site-specific basis in the comprehensive performance test work plan and operating and maintenance plan. Some suggested options might include:

- "Breakthrough" calculations that are based on worst case expected flue gas constituents and known carbon bed adsorption characteristics (e.g., saturation loading levels, etc.);

- Accelerated age bench scale simulation testing of carbon bed models;
- Hydrocarbon or mercury CEMS to detect bed breakthrough; and/or
- Performance testing at the desired lifetime of the carbon.

Flue gas temperature -- Flue gas temperature in the bed is important because a temperature spike in the bed may cause adsorbed PCDD/PCDF (and Hg and other heavy metals and organics) to desorb and reenter the stack gas emissions stream. Most facilities utilize some type of PM control device upstream of the carbon bed, and inlet temperature to the PM control device must be maintained below a certain level to avoid PCDD/PCDF formation, ensure control of SVM, prevent damage to the control device, etc.

A separate limit on the maximum carbon bed operating temperature is required. The limit may be complied with at the inlet or the exit of the bed. The limit is complied with on a 1-hour rolling average period, and is based on the average of each of the individual test condition run averages during the comprehensive performance testing.

3.5.4 Catalytic Oxidizer

For catalytic oxidizers, flue gas temperature and flowrate, catalyst age, catalyst type, and flue gas CO, HC, or PIC constituent levels may be indicators of catalyst performance.

Flue gas temperature -- Limits on both minimum and maximum flue gas temperature are required. Both limits are set at the inlet of the catalytic oxidizer.

Rationale -- Maintaining a minimum inlet temperature is important because catalytic oxidation and destruction rates decrease with decreasing temperature. A maximum limit is important because operation at high temperature can lead to catalyst degradation and reduced catalytic activity.

Limit compliance period -- Minimum and maximum inlet temperature limits are complied with on a (not-to-exceed) 1-hour rolling average period.

Limit basis -- The minimum temperature limit is based on the average of the individual test run averages from the comprehensive performance testing.

The maximum temperature limit is based on equipment manufacturer or designer specifications. Rationale for the limit is to be included in the performance test plan submitted for Agency review and approval.

Measurement techniques -- Flue gas temperature in the catalytic oxidizer control device can be measured with similar techniques to those discussed in Section 9 for combustion gas temperature.

Flue gas flowrate -- A limit on the maximum flue gas flowrate through the catalyst is required. This is to ensure that the flue gas has adequate residence time in the catalyst bed. Limit compliance period, basis, and measurement methods are discussed in Section 9.

Catalyst age -- A limit on the maximum catalyst age is required.

Rationale -- Catalysts can fail due to deactivation because of poisoning or over-temperature. Deactivation typically will take place over a long time period. However, note that in some less common situations, the deactivation may not be gradual (e.g., deactivation from poisoning or over-temperature may occur in a relatively short time period). In this case, the age limit will not be of use for indicating catalyst failure.

Limit compliance period -- Catalyst age is determined by the amount of combustion flue gas volume that has been processed by the catalyst.

Limit basis -- Due to the difficulty in determining appropriate age limits through comprehensive performance (or confirmatory performance) testing, it is recommended that age limits be set with manufacturer and/or designer specifications that are based on expected operating conditions. Rationale for the limit is to be included in the comprehensive performance test plan submitted for Agency review and approval.

Catalyst type -- The same type of catalyst that is used in the comprehensive performance tests must be used in normal operation. When the catalyst is replaced, it must have equal or better performance qualities (e.g., design and construction material properties) to that used during the comprehensive testing. Design parameters must include:

- Loading of catalytic metals -- Minimum catalytic metal loading is important because the catalytic metal level is directly related to catalyst operating performance. Loading should be specified in the reviewed and approved performance test plan (e.g., weight catalyst metal per area or weight of catalyst, weight of catalyst per catalyst space velocity, etc.).

- Space velocity -- Space velocity is important because it is a measure of the gas flow residence time in the catalyst; the longer the time (the lower the space velocity), the more potential for reactions to take place.

- Monolith substrate construction -- Catalyst substrate constructions may include monoliths or pellets. The catalyst monolith pore density and catalyst washcoat support should be similar to that used in the comprehensive performance tests.

Rationale for catalyst performance specification operating limits must be included in the comprehensive performance test plan submitted for Agency review and approval.

Flue gas PICs -- Typically, continuous monitoring of flue gas HC, CO, or speciated PICs is used as a direct indicator of catalyst operating performance. However, due to the low levels typical in incinerator flue gases, and the uncertain relationship between these organic compounds and PCDD/PCDF, this may not be indicative of performance for PCDD/PCDF. Limits are thus not required.

Temperature increase -- A flue gas temperature rise across the catalyst unit may provide an indication of catalyst performance because the oxidation processes generate heat. However, for hazardous waste burner flue gas streams which typically have low levels of organics, the temperature increase from organic oxidation/destruction may not be measurable or distinguishable from standard variability and measurement noise. Thus, a limit on the flue gas temperature increase across the catalyst bed is not required.

Pressure drop -- Pressure drop across the catalyst bed may be an indicator of proper catalyst to flue gas contacting. Low pressure drop maybe an indication of holes in the bed, which may allow gas to pass untreated through the bed. However, this parameter is not a required operating parameter because it does not generally have a strong effect on the performance of well-designed, operated, and maintained catalytic oxidizers.

4.0 Particulate Matter

Particulate matter (PM) is used as a surrogate for control of the nonenumerated CAA metal HAP -- Co, Mn, Ni, Sb, and Se, from all feedstreams. The nonenumerated metal HAP are those metals for which there is not a direct MACT emissions standard. These metals are either low volatile or semivolatile in behavior and are controlled effectively by controlling PM. PM is also used as a compliance parameter for assuring control of the regulated semivolatile and low volatile metals that are absorbed to the PM to levels demonstrated during the comprehensive performance test.

It is preferred (although not required) that PM be directly monitored on a continuous basis using a CEMS as discussed in Section 13 or a PM detection system as discussed below in Sections 4.3.1 and 4.3.2.

Operating parameter monitoring and control options for assuring control of PM emissions are discussed in the following subsections, and include limits on: (1) waste feed composition; (2) parameters affecting ash partitioning to the combustion chamber ("bottom ash") and flue gas ("fly ash"); (3) PM air pollution control device operational parameters that are indicative of control device performance; and/or (4) PM detectors. Operating parameter requirements for assuring control of PM are summarized in Table 4-1. Alternate operating parameters may be requested as part of an Agency-reviewed and approved performance test plan under §63.1209(g).

Table 4-1. Particulate Matter Compliance Requirements

Control Technique	Compliance Using	Limits From	Averaging Period[3]	How Limit Is Established
Limit on Maximum Ash Feedrate (Incinerators and Boilers)[2]	Sampling and analysis of all feedstreams for ash and a continuous monitoring system (CMS) for feedstream flowrate	Comprehensive performance test	12-hour	Avg of the test run averages
Wet Scrubber: High Energy	CMS for maximum flue gas flowrate or kiln production rate	Comprehensive performance test	1-hour	Avg of the maximum hourly rolling averages for each run
	For high energy wet scrubbers only, CMS for minimum pressure drop across scrubber	Comprehensive performance test	1-hour	Avg of the test run averages

	For high energy wet scrubbers only, CMS for limit on minimum scrubber liquid flowrate and maximum flue gas flowrate or CMS for limit on minimum liquid/gas ratio	Comprehensive performance test	1-hour	Avg of the test run averages
All Wet Scrubbers	CMS for limit on minimum blowdown rate plus a CMS for either minimum scrubber tank volume or level, or	Comprehensive performance test	1-hour	Avg of the test run averages
	CMS for solids content of scrubber water, or	Comprehensive performance test	12-hour	Avg of the test run averages
	Manual sampling for solids content of scrubber water[1]	Comprehensive performance test	1-hour	Avg of manual sampling run averages
Fabric Filter	Bag leak detection system or PM detection system	Site-specific	PMDS: 6-hr rolling avg	Site-specific
Electrostatic Precipitator and Ionizing Wet Scrubbers	PM detection system or site-specific Operating Parameter Limits	Site-specific	PMDS: 6-hr rolling avg Site-specific for others	Site-specific

[1] Unless you elect to comply with a default sampling/analysis frequency for solids content of the scrubber water of once per hour, you must recommend an alternative frequency in the comprehensive performance test plan that you submit for review and approval.
[2] Not required for units that use FFs or ESPs which choose to use the PM detectors compliance option.
[3] All averaging periods are not-to-exceed values.

4.1 Feed Control

The ash content of combustor feedstreams as well as other constituents that may affect PM size distribution directly impact PM emissions.

Ash feedrate -- For boilers and incinerators, a limit on the maximum ash feedrate is required by the rule. Note that ash feedrate limits are not required for systems which use a baghouse (which as discussed below, require the use of either a bag leak detector system or PM detector system) or an ESP or IWS and elect to use a PM detector system for compliance assurance.

Rationale -- A maximum ash feedrate limit is set to prevent "overloading" of the PM air pollution control device. Overloading may lead to increased PM stack gas emissions. Because a fraction of the ash fed to the hazardous waste incinerator (contained in the hazardous waste fuels, process raw materials, or auxiliary fuels) is entrained in combustion flue gas, higher ash flue gas loadings generally result in increased levels of PM emissions, especially for systems with no PM air pollution control device, systems with inefficient PM control devices, electrostatic precipitators with inefficient operating and control systems, etc. The entrained ash fraction may be especially high for fluidized bed, rotary kiln, and liquid waste injection type of hazardous waste incinerators.

As currently in the RCRA BIF rule, an ash feedrate limit is not required for the industrial process hazardous waste combustor categories of cement and lightweight aggregate kilns. This is because the dominant source of entrained PM from these facilities comes from raw materials.[8] In these systems, entrained raw materials comprise the majority of the PM emissions, and thus a variation in the PM loading to the inlet of a PM air pollution control device is primarily a function of factors other than the ash content of hazardous waste fuels (e.g., production rate).

Limit compliance period -- The limit is based on a not-to-exceed 12-hour averaging period, which as discussed in Section 2, and Sections 5, 6, and 7 for metals and chlorine feedrate limits, is consistent with the time-period duration of the typical compliance testing condition (3 x 4-hour run test condition).

Limit basis -- The limit is determined as the average of the individual test run averages, from all runs from the pertinent comprehensive performance test condition associated with PM stack gas compliance measurements.

Measurement techniques -- Compliance is based on the determination of ash concentrations in feedstreams and determination of total feedstream feedrates. ASTM Method D482-87 (sample drying and ignition) is recommended for ash analysis of waste feed materials. Feedrate measurement techniques are discussed in Section 9.

Characterization requirements during day-to-day compliance operations -- Sampling and analysis for determining feedstream ash content must be conducted "as often as necessary to

[8] Although all existing solid fuel boilers burn coal which is generally the dominant source of particulate matter, some solid fuel boilers burn high ash content hazardous waste which can contribute substantially to the particulate loading. Thus, the rule requires that solid fuel boilers establish an ash feedrate limit to ensure compliance with the PM standard, unless the boiler uses a PM detector for compliance assurance.

ensure that the results are accurate and up-to-date and to demonstrate that the unit operates within the permit limits". Feedstream analysis procedures and frequency are developed on a site-specific basis, and contained in the facility's feedstream analysis plan (similar to the current RCRA required "waste analysis plan"). The feedstream analysis plan must be submitted with Agency-reviewed and approved performance test plan. The feedstream analysis plan is discussed in Section 20.

Waste composition -- Certain feedstream inorganic constituents can affect the size distribution of the generated PM (e.g., salts and metal compounds will tend to form fine particulate which is difficult for the PM air pollution control device to control). Limits on maximum metals and chlorine feedrates are considered elsewhere in this document for other reasons. In site-specific cases, restrictions may be considered on the amounts of other components of waste that are typically burned and suspected to affect PM size distribution, as part of the permit conditions. In general though, there are no specific waste composition limit requirements to control PM size distribution beyond those used for chlorine and metals control.

4.2 Entrainment

Flue gas flowrate -- A limit on maximum flue gas flowrate through the combustor chamber(s) is used to control the entrainment of PM contained in the flue gas. Decreased gas flowrate acts to maximize the amount of ash that remains in combustor, and minimize the amount of ash that is entrained in the combustor flue gases that must be controlled prior to release to the atmosphere. A maximum limit on flue gas flowrate is also required to address a variety of other needs, including assuring proper air pollution control device operation, combustion efficiency, etc. Compliance period limit (1-hr rolling average), basis (average of performance test highest hourly rolling averages), and measurement techniques are discussed in Section 10.

Note that the flue gas flowrate limit is not required for systems which use baghouses (which as discussed below, require the use of bag leak detector systems) or use ESPs and select to use a PM CEMS compliance approach.

Sootblowing -- Most boilers, and some incinerators and HCl production furnaces, use waste heat boilers or heat exchangers for heat recovery. "Sootblowing" is typically used in these systems for cleaning of collected PM from the heat exchanger tubes, because the build-up of PM leads to reduced heat transfer and energy recovery. During the sootblowing, which is typically performed at periodic intervals, increased PM emissions may result compared with operations when sootblowing is not taking place.

The HWC MACT standards were developed by excluding data from all individual tests runs during which sootblowing was used. (Under current RCRA BIF requirements, sootblowing was conducted during one of the test runs; and sootblowing corrected average PM and metals results were reported.). Thus, for the HWC MACT rule, no special considerations need to be made for sootblowing during compliance testing.

4.3 Air Pollution Control Devices

Compliance requirements for PM air pollution control device performance are discussed below for the following commonly used control devices including: fabric filters, electrostatic precipitators, high energy wet scrubbers, low energy wet scrubbers, ionizing wet scrubbers, other novel wet scrubbers, and high efficiency particulate air filters.

Due to the variety of different designs and operations of air pollution control equipment (and new advanced systems that are being developed), as well as differences in site-specific operations, it is not possible to cover (or anticipate) appropriate operating parameters for all types of devices. In these cases, facilities may request additional requirements or a waiver from certain requirements through a petition to the Agency for alternative monitoring procedures that are appropriate and adequate for assuring proper operation of the air pollution control system under §63.1209(g).

4.3.1 Fabric Filters

PM emissions from fabric filter tend to be a result of filter holes (tearing and/or rupturing), bleed-through migration of particulates through the filter and cake, and small filter cake “pin-holes”, none of which are related to fabric filter operating parameters. Thus, fabric filter (baghouse) operating parameters limits (such as gas flowrate or bag pressure drop) are not used to ensure fabric filter performance. Instead, all HWC combusors that use fabric filters are required to use either a “bag leak detector system” (BLDS) under §63.1206(c)(8) or a PM detection system (PMDS) under §63.1206(c)(9) to identify baghouse malfunctions.

Either detection system must: (1) be certified by the manufacturer to be capable of continuously detecting and recording particulate matter emissions at concentrations of 1.0 milligrams per actual cubic meter unless you demonstrate, under §63.1209(g)(1) that a higher detection limit can detect mass PM loadings during normal operations; and (2) provide output of relative PM mass loadings. Several types of instruments are available from a variety of commercial vendors for this purpose. They include the PM detectors based on light scattering (e.g., in-situ light scattering and light scintillation monitors), as well as “triboelectric” or “tribokinetic” monitors which detect PM based on electric charge transfer (and which are commonly used for BLDS). Triboelectric monitors are being (or have been) used by secondary lead smelters, some LWAK and CKs, as well as two HWIs. Additionally, light scintillation instruments are used by many secondary lead smelters.

Operation and maintenance procedures for the BLDS or PMDS as well as corrective measures requirements when an alarm level is exceeded must be included in the operating and maintenance plan required under §63.1206(c)(7).

If you use a conventional triboelectric or tribokinetic monitor in a BLDS, you must install and operate the system, and establish the alarm set point, considering the principles provided in USEPA, "Fabric Filter Bag Leak Detection Guidance," EPA Office of Air Quality Planning and Standards, EPA-454/R-98-015, September 1997.

If you use an in-situ light-scattering, light scintillation (e.g., transmissometer) or other monitor in a PMDS, you must establish the alarm set point using the same procedures described below in Section 4.3.2 for ESPs and IWSs.

Following an alarm indicating a baghouse malfunction, a corrective measures plan must be followed, as contained in the operating and maintenance plan. The corrective measures plan details the corrective actions that will be taken to fix the baghouse performance problem (reduce the PM emissions).

Additionally, if the alarm sounds for more than 5% of the operating time during a 6-month period, notification must be made to the delegated authority within 30 days of the end of the 6-month block period. The notification must describe the cause of each exceedance of the alarm, and revisions to the design, operation, or maintenance of the system to minimize future exceedances.

Recommended BLDS and PMDS quality assurance and control checks include a monthly "response" test, and monthly instrument electronic drift tests, as also detailed in the operating and maintenance plan.

Note that BLDS or PMDS alarms do not have to be linked to the hazardous waste automatic waste feed cutoff system.

Appendix C includes more information and guidance on the use of PMDS.

4.3.2 Electrostatic Precipitators

The PM capture efficiency of electrostatic precipitators (ESPs) is a function of a variety of parameters, including:

- Specific collection area (a function of ESP plate area and flue gas flowrate).
- Particulate matter characteristics, such as diameter and the resistivity and viscosity of the flue gas, which are difficult to continuously monitor.
- Electric field collection intensity and particulate matter charge intensity (which are both functions of ESP voltage and current).
- Distribution of power to various fields and sections of the ESP.

Because of the complexity of operation and differences in equipment design, compliance monitoring may be made through either:

(1) Using a PM detection system (PMDS) for process monitoring to determine when PM mass emissions exceed an alarm set-point. Corrective measures must be taken, as specified in the operating and maintenance plan, when the set-point is exceeded.

(2) Establishing operating parameter limits on a site-specific basis and link the limits to the AWFCO system.

PM Detector System (PMDS) Option

A PMDS may be used to directly monitor relative mass emissions of PM. See §63.1206(c)(9).

If you elect to use a particulate matter detection system in lieu of site-specific operating parameters for your electrostatic precipitator or ionizing wet scrubber, you must establish the alarm level using either of two approaches. See Appendix C for detailed information. Under either approach, you may maximize controllable operating parameters during the comprehensive performance test to simulate the full range of normal operations (e.g., by spiking the ash feedrate and/or detuning the electrostatic device).[9]

You may establish the alarm set-point as the average detector response of the test condition averages during the comprehensive performance test.

Alternatively, you may establish the alarm set point by extrapolating the detector response. Under the extrapolation approach, you must approximate the correlation between the detector response and particulate matter emission concentrations during an initial correlation test. You may extrapolate the detector response achieved during the comprehensive performance test (i.e., average of the test condition averages) to the higher of: (1) a response that corresponds to 50% of the particulate matter emission standard; or (2) a response that correlates to 125% of the highest particulate matter concentration used to develop the correlation.

To establish an approximate correlation of the detector response to particulate matter emission concentrations, you should use as guidance Performance Specification-11 for PM CEMS (40 CFR Part 60, Appendix B), except that you need only conduct 5 runs to establish the initial correlation rather than a minimum of 15 runs required by PS-11. For quality assurance, you should use as guidance Procedure 2 of Appendix F to Part 60 and the detector manufacturer's recommended procedures for periodic quality assurance checks and tests, except that:

---

[9] Note, however, that bypassing or detuning an emission control system could cause PM stratification and could make it difficult to pass the PS-11 performance criteria.

1. You must conduct annual Relative Response Audits as prescribed by Section 10.3 (6) of Procedure 2; and
2. You need only conduct Relative Response Audits on a 3-year interval after 2 sequential annual Relative Response Audits document that the correlation is within 20% of the reference method measurement at emission concentrations achieved during the comprehensive performance test.

The rule requires only minimal correlation testing because the particulate matter detection system is used for compliance assurance only—as an indicator for reasonable assurance that an emission standard is not exceeded. The particulate matter detection system is not used for compliance monitoring—as an indicator of continuous compliance with an emission standard. Because particulate matter detection system correlation testing is much less rigorous than the correlation testing required under PS-11, the particulate matter detection system response cannot be used as credible evidence of exceedance of the emission standard.

The type of PM detectors that is selected must be discussed in the Agency reviewed and approved CMS performance test plan as required by §63.1209(d). The detector must have measurement sensitivity sufficient to respond to changes in PM mass emissions within the range of normal operations. You should document with empirical data or information as part of the CMS performance test plan the range of normal PM emissions as well as the level of detection for the detector.

It is recommended that beta-gauge monitors be considered first. Beta monitors are commercially available, can be used on moisture-saturated stack gases, and their response relatively insensitive to changes in PM size distribution and other PM characteristics. Various light scattering methods may also be appropriate. Triboelectric detectors, commonly used for baghouse monitoring, are not appropriate for ESP or IWS monitoring because their response is dependent on both particle concentration and particle charge levels. The additional dependence of particle charge adversely affects their response to be only dependent on PM emission levels.

Requirements for corrective measures and excessive alarm level exceedance notifications are the same for PMDS as for BLDS. See §§63.1206(c)(8)(iii and iv) and 63.1206(c)(9)(iii and iv).

Site Specific Operating Parameter Limits Option

Under Option (2), operating parameter limits are used to ensure that ESP or IWS performance during normal operations is equivalent to that achieved during compliance testing. The operating limits must be linked to the automatic waste feed cutoff system. Operating parameter limits are requested on a site-specific basis (similar to under §63.1209(g)(1)) as part of the Agency reviewed and approved comprehensive performance test plan.

It is recommended that the following operating parameters be considered:

- Flue gas flowrate (or production rate) -- A limit on maximum flue gas flowrate, based on comprehensive performance testing. An increase in flue gas flowrate results in an increase in velocity through the precipitator, a decrease in particle residence time between the charging and collecting plates, and a lower ESP collection efficiency. Also, increased flue gas flowrate can result in higher PM loading to the ESP due to increased entrainment from the combustor.

- Power input – A limit on minimum ESP power input, based on performance testing. Numerous field testing measurements show that ESP collection efficiency is a very strong function of power input (both current and voltage):

  -- Increased voltage leads to increased electric field strength forcing PM to the collection plates. This results in an increase in the saturation (or limiting) charge level that the particulate can obtain, and an increase in charged particulate migration rate to the collection electrode.

  -- Increased current leads to an increased particle charging rate, and an increased electric field strength near the collection electrode due to "ionic space charge" contribution, and thus increased particle transport rate to the collection electrode.

Power input limit implementation schemes to consider include (presented in order of decreasing compliance assurance and decreasing complexity):

-- Individual power limits on each independently controlled field.

-- A total power input limit, with the additional requirement that ESP power increase across the ESP (e.g., for a 4-field ESP, the power to the last field 4 is higher than the power to field 3, field 3 power is higher than field 2, etc.).

-- A total power input limit and a limit to the power of the last couple fields.

-- Multiple power limits for various, distinctly different modes of operation (different waste types, compositions, etc.).

Selection will depend on ESP design and operational and emission control performance characteristics.

- Spark rate – A limit on minimum (and possibly maximum) spark rate. This is especially appropriate for ESPs with state-of-the art automatic voltage controllers which are designed to provide maximum instantaneous voltage input based on maintaining a set minimum "spark rate".

- Specific power – A limit on minimum specific power. Specific power is the ratio of the ESP input power to the gas flowrate.

- ESP "Predictive Emissions Monitoring – It is highly recommended that operating parameter monitoring (including opacity, field power input levels, gas flowrate, etc.) be combined with recently developed ESP "Predictive Emissions Monitoring" computer modeling programs that relate operating parameters to specific PM emissions levels.

- Collection plate rapping cycle frequency, duration, and intensity -- Transient PM emission spikes are typically directly related to collection plate rapping (cleaning) cycles. Thus it is important to ensure that comprehensive (and confirmatory) tests include such representative cycles within the duration of each of the tests. Additionally, it is important that plate rapping cycle frequency, duration, and intensity used in on-going operations are similar to those used in the performance test demonstrations. In some cases, where it may be appropriate to determine actual average emissions levels from test runs with and without cleaning cycles, the RCRA BIF guidance soot-blowing averaging procedure should be used when plate rapping is an occasional event.

The parameters discussed above apply to both dry and "wet" ESPs, except for collection plate rapping / cleaning. For some wet ESP designs, where a continuous liquid film is flushed over the collection surface or spray nozzles are used to continuously flush the collection surface, it is appropriate to set a limit on the solids content of the liquid wash solution, as discussed below for high and low energy wet scrubbers. This is especially important for most applications where the liquid stream is recycled.

4.3.3 High Energy Wet Scrubbers

High energy scrubbers are designed specifically for PM control. They also can be very efficient at acid gas control. High energy scrubbers include common venturi-type scrubbers, as well as novel scrubber designs including free-jet, collision/condensation, and rotary atomizing designs. High energy scrubbers rely on finely atomized water droplets for impacting and collecting PM. Capture efficiency is generally maintained in high energy wet scrubbers by:

- Providing high relative velocity between solid PM and liquid droplet phases to enhance particle/droplet collisions.

- Minimizing the diameter of the atomized liquid scrubber droplets.

- Minimizing entrainment of agglomerated PM/liquid droplets.

Thus, scrubber pressure drop, scrubber solids content (or blowdown rate and system liquid volume), liquid-to-gas ratio, liquid injection nozzle pressure, and liquid surface tension may provide an indication of scrubber performance.

Pressure drop -- A limit on minimum scrubber pressure drop is required.

Rationale -- High energy (e.g., venturi) scrubber removal efficiency is a strong function of pressure drop (and particulate diameter). Particle capture in venturi scrubbers is a function of the degree of liquid atomization that is achieved and of the amount of mixing and relative velocities between the flue gas particulate and liquid droplets, which are both dependent on the flue gas velocity across the device (pressure drop across the venturi is a direct measure of flue gas velocity).

Limit compliance period and basis -- The minimum limit is set based on a 1-hour rolling average period. It is set based on the average of the individual test run averages from the comprehensive performance test demonstrations.

Control -- Pressure drop is usually automatically controlled through the adjustment of the throat area (e.g., with a cone or nozzle that moves back and forth in the throat; adjustable butterfly value in the throat region; or use of baffle, dampers, or adjustable inserts in the throat area). The pressure drop is typically measured across the entire scrubber, including the demister.

Note that there are some simple system designs where the throat is fixed. For these cases, there may be some difficulty and conflict in setting simultaneously achievable limits on both maximum flue gas flow rate and minimum scrubber pressure drop. Multiple test conditions may be necessary to allow for operation under different modes spanning the desired range of operation. See Section 23 for a discussion of operating under different modes.

Measurement Techniques -- Pressure drop can be measured using manometers or differential pressure transducers.

<u>Liquid blowdown rate (or liquid solids content)</u> -- A limit on either: (1) maximum liquid solids content; or (2) minimum liquid blowdown rate and minimum scrubber liquid volume or tank level is required.

Rationale -- Control of the dissolved and suspended solids content of the scrubber liquid is important because increased solids content of the scrubber liquid increases the amount of particulate solids that can be reentrained in the scrubber exit gas. Additionally, high liquid solids content may act to plug system components leading to deterioration in system performance.

Compliance can be demonstrated by either: (1) direct monitoring of the scrubber liquid solids content; or by (2) indirectly maintaining a minimum liquid blowdown rate and minimum liquid replacement rate or minimum liquid system volume.

Under Option (1), as discussed below, continuous scrubber solids content monitoring techniques are available. Alternatively, under Option (1), periodic scrubber liquor manual sampling and analysis procedures may be used to ensure proper scrubber liquid composition (especially appropriate in cases where solids content of the scrubber liquid is not expected to fluctuate widely). A sampling and analysis frequency of one hour is recommended. An alternative frequency may be requested as part of the comprehensive performance test plan, submitted for Agency review and approval.

Under Option (2), scrubber liquor blowdown rate and scrubber tank volume or level are maintained to ensure that the solids content is maintained at the level demonstrated in the performance testing. Liquid blowdown is the fraction of the liquid captured and removed from the scrubber that is not recycled for reuse back into the scrubber. Greater blowdown means that less recycled liquid is mixed with fresh liquid, and that the liquid in the scrubber is "cleaner". However, more liquid must be wasted. When complying with the minimum liquid blowdown rate, it is also important to ensure that the overall system scrubber liquid volume is properly maintained. Continued depletion in the total liquid system volume (through blowdown and losses of moisture to the stack gases) would lead to an increase in the solids content of the liquor. System liquid volume is maintained through a minimum requirement on the liquor holding tank volumes (monitoring through level indicators for example), or a minimum requirement on replacement liquor addition rate (fresh water recharge rate).

Note that for facilities complying with Option (2) using a limit on blowdown rate and scrubber liquor system volume, it may be appropriate to set limits on the solids content of certain make up liquid streams that are added to the scrubber. Specifically, maximum limits would be set based on those demonstrated in the compliance testing. This would be appropriate for any make up liquid streams that are suspected to have significant solids content or have solids content which may fluctuate widely during normal operations compared with that during compliance testing.

Some wet scrubbers may choose to operate with intermittent, non-continuous liquid blowdown periods. In this case, compliance with a limit on liquid blowdown rate on a continuous basis is not appropriate. Instead, it is preferred that the facility comply directly with a limit on the scrubber solids content under Option (1). However, if this is not practicably determined, it may be appropriate to set limits on liquid blowdown minimum frequency, minimum duration, and minimum blowdown flowrate, and minimum scrubber liquid system volume. When the interval between successive blowdowns is short in comparison to the compliance test, a limit is set based on the minimum blowdown interval used during the compliance test. In situations where the desired blowdown interval is longer than the test interval, the comprehensive performance test should be conducted at the end of the desired blowdown cycle (i.e., just before a scheduled blowdown). The limit on blowdown frequency will be based on the time interval between the previous blowdown event (before the actual compliance test had started) and the end of the compliance test.

Note that a liquor "conditioning" period may be needed prior to testing to establish an equilibrium scrubber liquor composition.

Compliance period and basis -- Under Option (1), if scrubber liquor solids content is monitored directly on a continuous basis, 12-hour rolling average maximum limits are set based on the average of the individual comprehensive compliance testing run averages.

Alternatively under Option (1), if scrubber liquor solids content is monitored manually on an intermittent basis, a default sampling and measurement frequency of once per hour is specified. A petition for an alternative monitoring frequency can be made in the Agency-reviewed and approved performance test plan. Because of the nature of these measurements, there is no appropriate averaging period. Each of the hourly (or other approved frequency) measurements must meet the limit. The use of a composite of samples taken during intervals within the time period may also be requested. The limit is based on the average of periodic measurements made during the comprehensive performance testing runs, with the frequency specified in the performance test plan, and recommended to be taken at least twice per hour during the testing.

Under Option (2) for systems with continuous blowdown operations, 1-hour rolling average limits on blowdown rate and liquid tank volume/level are set. They are set based on the average of the individual test run averages of the comprehensive performance test demonstrations.

Also, as discussed above, for intermittent blowdown systems which intend to comply with the Option (2), the liquid blowdown rate, blowdown frequency, duration, and rate limits are based on those demonstrated in the compliance testing conditions. A petition to the Agency under §63.1209(g), as part of the comprehensive performance test plan, is needed for these facilities because the regulations do not cover this scenario.

Measurement techniques -- Under Option (1), a variety of scrubber liquor solids content continuous monitoring techniques are available for direct monitoring. These include conductivity, turbidity, and density methods:

- Conductivity -- Liquid "conductivity" meters are able to make an accurate assessment of both the dissolved and suspended solids liquid content.

- Turbidity -- Liquid "turbidity" meters, which operate similarly to stack gas opacity monitors based on solid particle light scattering, may also be appropriate. However, they may have limited or no response to dissolved solids (which are usually dominated by alkali salts).

- Density -- Liquid density monitors use a vibrating element, where the vibration frequency is a precise function of the density of the liquid surrounding the vibrating element. One potential limitation of density monitors is in cases where the suspended and dissolved solids have similar or comparable density to the liquid (i.e., density monitors are only effective at determining solids content when the solids content has a density that is sufficiently different from that of the liquid).

Calibration of these instrument responses with actual dissolved and suspended solids liquid content is critical to the operation of these monitors.

Under Option (2), liquid blowdown rate and liquid addition rate or tank volume can be monitored with a variety of liquid flowrate devices and level indicator devices discussed in Section 7.2.

Liquid-to-gas ratio -- A limit on the minimum liquid-to-gas ratio is required. The liquid-to-gas ratio is determined as the ratio of the scrubber liquid injection rate to the scrubber flue gas flowrate (actual scrubber gas flowrate).

Rationale -- At low liquid-to-gas ratios, capture efficiency decreases due to an insufficient number of liquid droplet targets. Liquid-to-gas ratio is maintained by adjusting the liquid injection rate or flue gas flowrate. Note that at very high liquid-to-gas ratios, efficiency may also decrease due to a change in the droplet size distribution formed in the scrubber. However, due to the lower probability of this occurring and lesser effect on capture efficiency, a limit on maximum liquid-to-gas ratio is not required.

Limit compliance period and basis -- A minimum limit is complied with on a 1-hour rolling average period. It is set based on the average of the individual test run averages from the comprehensive performance test demonstrations.

Note that for this and other "normalized" parameters which are a function of two independent operating parameters (not measured directly by one measurement technique), it may be adequate to set and comply with individual limits on each parameter, and not the ratio. Specifically, the flue gas flowrate is limited to a maximum level for various other purposes. Thus, a single limit on the minimum liquid flowrate is adequate as long as an alternate maximum limit is met on the flue gas flowrate through the scrubber. The liquid-to-gas ratio will always be higher than the performance test level as long as both a minimum liquid rate and maximum gas flow rate are being maintained because both increased liquid flow rate and decreased gas flow rates will result in higher liquid-to-gas ratio.

Measurement techniques -- Liquid-to-gas ratio is determined by measurement of liquid injection rate and flue gas flowrate. Measurement techniques for both of these parameters are discussed in Section 7.2.

Liquid injection nozzle pressure -- In some scrubbers designed for PM control, nozzles are used and relied upon to atomize the scrubbing liquid. For these systems, a limit on minimum nozzle pressure may be required to ensure adequate liquid atomization, as determined by permitting officials on a site-specific basis under the provisions of §63.1209(g)(2). It is recommended that compliance be based on a 1-hour rolling average time period, and that the limit be set based on manufacturer or equipment designer specifications.

Liquid surface tension -- Scrubber liquid surface tension affects scrubber performance. Decreasing liquid surface tension leads to improved scrubber emissions performance. With high liquid surface tension, particles tend to "bounce" off the liquid droplets and are not captured. High surface tension also has an adverse effect on droplet formation. However, because surface tension is not a dominant parameter for scrubber performance, and there is no easy way to continuously monitor or control it, it is not required as an operating limit.

4.3.4 Low Energy Wet Scrubbers

Low energy wet scrubbers, such as spray towers, tray towers, or packed bed arrangements, are intended primarily for acid gas control. However, some degree of incidental PM control may take place in low energy wet scrubbers through collection of PM in low energy scrubber internals and scrubber liquor. Additionally, low energy wet scrubbers may be an important source of PM emissions due to entrainment of solid-containing scrubber liquor droplets.

Liquid feed atomization is critical for controlling acid gases and PM from certain low energy wet scrubber designs, such as spray towers. For these systems, a limit on liquid feed pressure is appropriate. Alternatively, many other low energy wet scrubber designs, such as packed beds and tray tower designs, do not generally rely on scrubber liquor atomization for control performance. For these systems, a source can petition the Agency under §63.1209(g)(1) to waive a liquid pressure limit requirement.

The primary consideration in low energy wet scrubber operations related to controlling PM emissions is limiting the solids content of the scrubber liquor. An increase in the solids content of entrained scrubber liquor droplets can translate to an increase in PM emissions. Requirements for controlling and monitoring scrubber liquor solids content are identical to that discussed above for high energy wet scrubbers.

4.3.5 Water Spray Quench for Gas Cooling

Water spray quenches are used for flue gas cooling upstream of wet scrubbers. Depending on the arrangement, the quench can be considered either as a separate unit, or contained within the wet scrubber. Scrubber liquor that is removed and recovered in the wet scrubber is almost always treated and recycled back into the scrubber and water quench. Fresh liquid must be continuously added either directly in the quench or mixed with the recycled scrubber liquor to make up for water vapor lost in the stack gases. When a liquor recycle loop is used, limiting the solids content of the recycled scrubber liquor with procedures discussed above for both high and low energy scrubbers is an appropriate indicator of the solids content of the make up water for the quench.

Water spray quenches can also be used for flue gas cooling upstream of "dry" PM collection devices, such as FF or ESPs, or for gas cooling for stack release purposes. In these cases, there is no water recycle loop because all injected water leaves the stack as vapor. A limit on quench water solids content may be appropriate in cases where the quench water has high solids content or where the quench water solids content may be expected to vary significantly from that used in the compliance testing. Also, a quench water solids content limit may be especially appropriate when no downstream PM control devices are used.

4.3.6 Ionizing Wet Scrubbers

Ionizing wet scrubbers are a combination of wet ESPs and packed bed wet scrubber technologies. Thus they have similar operating parameter requirements to those discussed for ESPs and low energy wet scrubbers.

4.3.7 Other Wet Scrubber Types

In addition to high energy, low energy, and ionizing types discussed above, there are many other different types of wet scrubbers that can be used for particulate matter control that are difficult to classify. These scrubbers may have many similar types of operating parameters to those discussed above for high and low energy scrubbers. However, some may have other monitoring requirements such as minimum steam/air flow rate or injection pressure for condensing free jet types. In these cases, a petition must be made under §63.1209(g)(1) for appropriate alternative monitoring parameters. These should be contained in the Agency-reviewed and approved comprehensive performance test plan.

4.3.8 High Efficiency Particulate Air Filters

High efficiency particulate air filters (HEPA) are typically used on specialized incinerator systems that burn hazardous and radioactive "mixed" wastes for the highly efficient control of PM. The types of monitoring requirements for HEPA filters which are required include:

- Maximum gas flowrate as demonstrated in the comprehensive performance testing, similar to FFs and ESPs.

- Maximum and minimum allowable pressure drop as based on manufacturer or equipment designer/operator specifications. Typically, HEPA filter pressure drops are designed for 1 in. of H_2O when new. As particles are collected, pressure drop increases. When the pressure drop reaches 3 to 4 in. of H_2O the filter is replaced. HEPA filters are not cleaned as in fabric filter operations. Typical nuclear-grade filters are designed to safely handle up to 10 in. of H_2O. Also, a minimum pressure drop limit should be set and complied with on a continuous basis to ensure that there are no leaks or filter blowouts.

Setting of either a minimum or maximum HEPA filter pressure drop limit based on that demonstrated in comprehensive testing is not desirable:

- It is problematic to set limits on pressure drop (maximum or minimum) as demonstrated in comprehensive testing program because HEPA filter pressure drop changes very slowly due to very light inlet PM loadings from the use of a primary coarse and fine particulate control system (such as a fabric filter or scrubber) upstream of the HEPA filters.

- For HEPA filters pressure drop (low or high) should not have a major effect on capture efficiency:

  -- Demonstration of a minimum pressure drop limit is not necessary since with HEPA filters, the individual filter fibers themselves are relied upon for particle collection. HEPAs have many more and much smaller fibers compared with fabric filters (HEPA filter fibers are less than 1 Φm in diameter, compared with fabric filters which have fibers sometimes in the range of 50+ Φm). Thus, unlike fabric filters, "sieving" and dust cake build-up are not important or relied on for maintaining HEPA filter capture efficiency. In fact, sieving effects are limited because significant filter cake build-up on HEPAs is not allowed due to maximum pressure drop limitations.

  -- At higher filter pressure drop due to a build-up of collected particles, collection efficiency may increase due to a dust cake "sieving" effect as occurs with fabric filters. Alternatively, flue gas face velocities through the filter will increase as the filter pressure drop increases (since the gas velocity increases as the effective area decreases due to particulate build-up and obstruction); capture efficiency will decrease as velocity increases. In any case, particulate build-up resulting in increased pressure drop is likely to have only a limited improvement on HEPA filter performance. Thus demonstration of a maximum pressure drop limit during comprehensive testing is not desirable.

5.0 Mercury

Operating parameter monitoring and control requirements for assuring control of mercury emissions are discussed, including limits on: (1) mercury feedrate; (2) chlorine feedrate; (3) combustion temperature; and (4) mercury air pollution control device operating parameters. Operating parameter requirements for assuring control of mercury are summarized in Table 5-1.

Alternatively and preferably, mercury can be directly monitored on a continuous basis by mercury continuous emissions monitoring techniques (with either total species or elemental mercury monitoring devices), as discussed in Section 13.

Table 5-1. Mercury Monitoring Requirements

Control Technique	Compliance Using	Limits From	Averaging Period[3]	How Limit Is Established
Limit on Maximum Mercury Feedrate[1]	Sampling and analysis of feedstreams for mercury concentration and a continuous monitoring system for feedstream flowrate[1]	Comprehensive performance test	12-hour or Annual[2]	Average of the test run averages[3]
Activated Carbon Injection	Monitoring requirements are the same as required for compliance assurance with the dioxin/furan emission standard. See Section 3.			
Activated Carbon Bed	Monitoring requirements are the same as required for compliance assurance with the dioxin/furan emission standard. See Section 3.			
Wet Scrubber	Monitoring requirements are similar to those required for compliance assurance with the total chlorine emission standard. See Section 7.[4]			

[1] For incinerators, cement kilns, lightweight aggregate kilns, liquid fuel boilers feeding hazardous waste with an as-fired heating value <10,000 Btu/lb, and solid fuel boilers, this limit applies to the total mass feedrate from all feedstreams (except natural gas, process air, and feedstreams from vapor recovery systems). For liquid fuel boilers feeding hazardous waste with a heating value of 10,000 Btu/lb or higher, the limit applies to hazardous waste thermal feed concentration.

[2] For incinerators, cement kilns, lightweight aggregate kilns and solid fuel boilers, the averaging period is not to exceed 12-hours. For liquid fuel boilers, the averaging period is (not to exceed) annual (one-year).

[3] All averaging periods are not-to-exceed values.

[3] For liquid fuel boilers, the limit is projected based on the SRE demonstrated during the performance test and the MACT emissions limit.

[4] Limits are the same except that for mercury, there is no scrubber liquor pH requirement.

5.1 Combustor Operating Parameters

Mercury feedrate -- A limit on maximum mercury feedrate is required. The type of limit depends on the format of the HWC MACT standard:

- Incinerators, cement kilns, lightweight aggregate kilns, liquid fuel boilers that burn hazardous waste with a heating value less than 10,000 Btu/lb, and solid fuel boilers – A maximum limit on the total mass feedrate of mercury from all feedstreams is required (including hazardous waste, raw materials, fossil fuels, and/or other miscellaneous feedstreams).

- Liquid fuel boilers that burn hazardous waste with a heating value of 10,000 Btu/lb or greater – A maximum limit on the mercury hazardous waste thermal concentration (lb Hg in hazardous waste per Btu of hazardous waste).

Rationale -- The amount of mercury fed to the combustor directly affects mercury flue gas emissions and the ability of the air pollution control equipment to remove mercury. Mercury emission rates generally increase with increasing mercury feedrates. Unlike low volatile metals, no limit is set on the mercury feedrate in pumpable hazardous wastes because mercury is generally highly volatile in any form (i.e., pumpable vs non-pumpable).

Limit compliance period and basis -- The mercury feedrate limit averaging period depends on the basis of the MACT standard:

Liquid fuel boilers – Limit is complied with on an (not-to-exceed) annual (one-year) rolling average basis. The rolling average is updated hourly. As discussed in Section 2, the limit is determined as:

$$F_{Limit} = \frac{E_{HWC\,MACT}}{(1 - SRE)}$$

where:

F_{Limit} = Metal feedrate limit. The limit is based on hazardous waste thermal concentration (lb/MMBtu if burning hazardous waste with heating value of

10,000 Btu/lb or greater or ug/dscm if burning hazardous wate with heating value below 10,000Btu/lb)

$E_{HWC\,MACT}$ = HWC MACT emissions standard (lb/MMBtu if burning hazardous waste with heating value of 10,000 Btu/lb or greater or ug/dscm if burning hazardous wate with heating value below 10,000Btu/lb)

SRE = SRE for HAP, as demonstrated in a comprehensive performance test (%/100). If the source is not equipped with an air pollution control device that consistently and effectively controls the HAP metal (as documented by engineering judgment or previous test demonstrations), the SRE must assumed to be zero (0).

Incinerators and solid fuel boilers – Limit is complied with on a (not-to-exceed) 12-hour rolling average basis. The limit is based on the average of the individual test condition total mercury mass feedrate averages (average of each different pertinent test run of the pertinent comprehensive performance test condition where mercury stack gas compliance is being demonstrated).

Cement kilns and lightweight aggregate kilns – Limit is complied with on a (not-to-exceed) 12-hour rolling average basis. The limit is based on the average of the individual test condition total mercury mass feedrate averages or alternatively on the average of individual test condition hazardous waste mercury feedrate averages. Additionally, cement kilns must comply with a limit on the as-fired concentration of mercury in the hazardous waste feed (or a weighted average concentration if multiple wastes are being fired).

Treatment and handling of feedstream nondetects during compliance testing for setting and complying with feedrate limits -- For feedstreams used during performance testing for which mercury (or semivolatile or low volatile metals, chlorine, or ash) is present at levels below the method quantitation (or "detection") limit, separate mercury feedrate limits are set on those particular feedstreams. The limit for these waste streams is a "feedrate limit as nondetect", based on the full nondetect levels measured in the performance testing (as opposed to the use of one-half of the detection limit or "zero" for nondetect measurements).

There are no requirements for achieving certain detection limits (i.e., limits on minimum detection limits that must be obtained are not specified). This is due primarily to the difficulty in identifying a single (or multiple) detection limit that is appropriate for various feedstreams due to feedstream matrix impacts on achievable detection limits. Instead, site-specific target detection limits are to be submitted in an Agency-reviewed and approved comprehensive performance test plan and accompanying waste analysis plan. Evaluation of appropriate detection limit levels is based on considerations including:

- Costs associated with achieving different mercury detection limits during day-to-day operations; and

- Estimated maximum mercury emissions that would be projected to be associated with the feedstream at the detection limit (considering if appropriate any likely mercury control in the system), and comparison of this level with the emissions standard. For example, the use of higher detection limits may result in less assurance that the source is continuously complying with the emission standard.

Note that the performance test waiver provisions of §63.1207(m) for units feeding low levels of metal/chlorine require a source to assume that mercury is present at the full detection limit if the feedstream analysis results indicate mercury is not present at detectable levels. However, CKs and LWAKs may assume mercury is present in the raw material at one-half of the detection limit if the feedstream analysis determines mercury not to be present at detectable levels.

If, at any time during day-to-day operations, the feedstream analysis determines detectable levels in the nondetect feedstream, the facility is not considered to be "out of compliance", provided that:

- The total system feedrate (considering the detectable levels in the feedstreams, above or below the detection limit achieved in the performance test) is less than the total system feedrate limit determined from the compliance testing; or

- The total mercury feedrate converted to an emissions concentration assuming no system control (i.e., 0% system removal efficiency) is less than the mercury MACT standard (as calculated pursuant to the provisions of §63.1207(m), the low metals/chlorine feedrate emissions waiver).

Additionally, because detection limits will vary depending on waste matrix, analytical equipment and procedures, etc., it is envisioned that there will be some allowance for achievement of detection limits of the feedstream during day-to-day operations above (within reasonably attainable detection limits) those levels demonstrated in the performance testing. The acceptable upper detection limits will likely be specified in an Agency-reviewed and approved waste (feedstream) analysis plan. This will be addressed further in rule implementation guidance.

Handling of nondetects during day-to-day compliance operations -- Procedures for the treatment of nondetects in individual feedstreams when determining compliance with total feedrate limits are addressed on a site-specific basis in the feedstream analysis plan. In particular, how to add feed rates from individual nondetect feedstreams to other detected (and/or nondetected) feedrates from other feedstreams to determine the total mercury feedrate. Options include considering nondetect measurements as either full detection (as in current BIF compliance procedures), or at one-half the detection limit (also see section 2.5).

Note that as discussed above, for the purposes of complying with the performance test waiver provisions of §63.1207(m), mercury must be assumed to be present at the full detection limit, except for mercury nondetects in raw material feedstreams, where it may be assumed that mercury is present at one-half of the detection limit.

Measurement techniques -- Mercury feedrate is monitored by determining the mercury concentration in each feedstream and determining the flowrate of each feedstream. Mercury analysis (digestion and analytical techniques) is recommended with SW-846 7470 or 7471 (cold vapor atomic absorption spectroscopy) or any other test method demonstrated to have performance capabilities comparable to or better than SW-846 methods (as requested in an Agency reviewed and approved comprehensive performance test work plan, and feedstream analysis plan). Feedstream measurements techniques are similar to those discussed in Section 10.

Characterization requirements during day-to-day compliance operations -- Waste characterization requirements for assuring that mercury feedrates in all combustor feedstreams during day-to-day operations are below the allowable limit demonstrated in the compliance testing are specified in the facility's feedstream (waste) analysis plan. Requirements are identical to those discussed in Section 4 for ash characterization for PM control.

Characterization requirements for natural gas, process air, and vapor recovery system feedstreams -- Characterization of the metals and halogen content of natural gas, process air, and vapor recovery system feedstreams is not required to the same degree or frequency as waste and other feedstreams. For natural gas and process air, as discussed below, this is due to generally low (or non existent) metals and halogen content. For vapor recovery system feedstreams, this is because it is difficult, costly, and often dangerous to sample these feedstreams. Sampling frequency should be requested on a site-specific basis in the facility's waste analysis plan, considering the expected or documented range of metals and/or halogen levels, and difficulty in sampling. At a minimum, one-time assessments must be made of feedstream metals and/or halogen levels. This could, for example, be based on natural gas vendor characterization data. Expected levels of metals and halogens in these feedstreams (and rationale for these levels) must be contained in the Agency reviewed and approved waste analysis plan, as part of the comprehensive performance test plan. These levels must be accounted for when documenting compliance with applicable feedrate limits.

Various natural gas data indicate that metals and halogen levels are typically very low:

- Natural gas metals and chlorine analyses from three hazardous waste and natural gas cofired boiler CoC trial burn reports show that metals and chlorine concentrations are all very low (less than 0.2 ppmw). Specifically, mercury ranges from 0.0005 to 0.01 ppmw (likely based on nondetect measurements).

- Results of a recent survey on the composition of over 20 different natural gas samples showed that mercury was nondetect at a level of 0.02-0.2 Φg/m^3; arsenic was also always nondetect. Chlorinated organics were always nondetect; although no total or organic chlorine levels were reported.

- EPA's "ICCR" database has mercury stack gas emissions from 5 different natural gas fired heaters and boilers. All are nondetect at levels of less than 0.5 Φg/dscm.

- Only certain volatile forms of chlorine and mercury are potentially contained in natural gas. Solid phase LVM or SVM would not be expected to be contained in the gas phase. Chlorine and mercury may be present in the "raw" natural gas taken directly from the gas field. However, the gas is processed and cleaned prior to delivery. This cleaning involves condensing out moisture and other impurities in the raw gas; this cleaning process will act to remove chlorine, mercury, and other volatile constituents. In fact, condensation of mercury onto natural gas cleaning and processing equipment is a known problem because the mercury is corrosive to the equipment.

Chlorine feedrate -- Chlorine feedrate may be important when wet scrubbers are used for mercury control since wet scrubbers can be effective at controlling certain soluble mercury/chlorine compounds, but not effective at controlling many unchlorinated mercury species. Thus a limit requiring minimum chlorine feedrate may be technically appropriate. However, as a practical matter, because only small amounts of chlorine are required for the typically low levels of mercury in hazardous wastes, a minimum limit on chlorine is not needed on a national basis. Additionally, a limit requiring some level of chlorine to be added could be directly counterproductive for controlling chlorine and other metals stack gas emissions levels, where an increase in chlorine feedrate leads to a corresponding direct increase in chlorine and certain metals emissions.

5.2 Air Pollution Control Devices

5.2.1 Wet Scrubbers

Wet scrubbers may be effective at controlling certain soluble forms of mercury, primarily mercury chloride ($HgCl_2$). Additionally, scrubbers can control elemental mercury with the use of certain scrubber additives (such as $NaClO_2$, acidified $KMnO_3$, Na_2S, and trimercaptotriazine), that function to oxidize elemental mercury to a scrubber liquid soluble form.

Operating parameters that are indicative of mercury control for wet scrubbers are the same as those covered and discussed for chlorine control, with the exception of scrubber pH. For a discussion of the potential impact of scrubber pH on mercury removal efficiency, see discussion in USEPA, "Response to Comments to the Proposed HWC MACT Standards, Volume III: Compliance Issues," September 2005, Section 29

Where scrubber liquid additives are used specifically for mercury control (such as $NaClO_2$, acidified $KMnO_3$, Na_2S, and trimercaptotriazine), it may be appropriate to set additive usage rate limits (such as mass of additive per gas volume treated).

Also, it may be important to conduct sufficient HWC operations in a time period prior to the compliance test in order to establish a representative scrubber liquid equilibrium composition during the compliance test.

If a "total species" mercury continuous emissions monitor is used, then no monitoring of operating parameters related to mercury is required. However, if only an elemental mercury (Hg^E) continuous emissions monitor is utilized, wet scrubber operating parameters may need to be monitored because the non-elemental (e.g., ionic mercury) emissions are not accounted for by an elemental mercury monitor. This issue should be addressed in a petition submitted to the Agency pursuant to §63.8(f) (i.e., the petition where a source requests to use a mercury CEMS).

5.2.2 Carbon Injection

Carbon injection can be used for controlling mercury emissions. Operating parameters that are indicative of mercury control are identical to those discussed for PCDD/PCDF control.

5.2.3 Carbon Beds

Carbon beds can be used for controlling mercury emissions. Operating parameters that are indicative of mercury control are identical to those discussed for PCDD/PCDF control.

5.2.4 Others

Other techniques that may be used for mercury control include selenium filters, sodium sulfide injection, and noble metal filters. Sodium sulfide injection monitoring parameters may be analogous to those for carbon injection. Selenium and noble metal filter parameters may be analogous to those for carbon beds and fabric filters.

6.0 Semivolatile and Low Volatile Metals

Semivolatile (SVM) metals that are directly regulated via emissions standards are lead and cadmium. Low volatile (LVM) metals that are directly regulated via emissions standards are arsenic, beryllium, and chromium. This section discusses operating parameter monitoring and control requirements for assuring control of SVM and LVM emissions. Potential parameters that affect SVM and LVM emissions include:

- Combustor operating parameters:
  - -- Metals feedrate
  - -- Metals volatility, which is primarily a function of:
    - .. Chlorine feedrate
    - .. Combustor temperature
  - -- Combustor gas flowrate
- Air pollution control device operational characteristics

Operating parameters that are required for LVM and SVM control are summarized in Table 6-1.

Alternatively and preferably, direct flue gas continuous emissions monitors for SVM and LVM metals may be used in place of operating parameter limits. As discussed in Section 13, multimetal CEMS development continues to advance through recent limited demonstrations at various hazardous waste incinerators. However, to date, CEMS performance, accuracy, reliability, etc. have not been adequately demonstrated to a degree that justifies use of these monitors on all hazardous waste combustors.

Table 6-1 Semivolatile and Low Volatile Metals Monitoring Requirements

Control Technique	Compliance Using	Limit From	Averaging Period[3]	How Limit Is Established
Good Particulate Matter Control	Monitoring requirements are the same as required for compliance assurance with the particulate matter standard. See Section 4.			

Limit on Maximum Inlet Temperature to Dry Particulate Matter Control Device	Continuous monitoring system (CMS)	Comprehensive performance test	1-hour	Avg of the test run averages
Limit on Gas Flowrate to Control Metals Entrainment	CMS for maximum gas flowrate or kiln production rate	Comprehensive performance test	1-hour	Avg of the maximum hourly rolling averages for each run
Limit on Maximum Semivolatile and Low Volatile Metal Feedrates (Pumpable and Non-Pumpable)[1]	Sampling and analysis of feedstreams[1] for metals concentrations and a CMS for feedstream flowrate	Comprehensive performance test	12-hour or Annual[2]	Avg of the test run averages
Limit on Maximum Pumpable Low Volatile Metal[1]	Sampling and analysis of feedstreams[1] for metals concentrations and a CMS for feedstream flowrate	Comprehensive performance test	12-hour or Annual[2]	Avg of the test run averages
Limit on Maximum Total Chlorine Feedrate from all Feedstreams	Sampling and analysis of feedstreams[1] for chlorine and chloride concentrations and a CMS for feedstream flowrate	Comprehensive performance test	12-hour	Avg of the test run averages

[1] For incinerators, liquid fuel boilers feeding hazardous waste with a heating value less than 10,000 Btu/lb, and solid fuel boilers, limits are based on total mass feedrates from all streams (except natural gas, process air, and feedstreams from vapor recovery systems). For cement kilns, lightweight aggregate kilns, and liquid fuel boilers burning waste with a heating value of 10,000 Btu/lb or greater, limits are based on thermal feed concentration in hazardous waste.
[2] For incinerators, solid fuel boilers, cement kilns, and lightweight aggregate kilns, limits are based on a (not-to-exceed) 12-hour rolling average. For liquid fuel boilers, limits are based on (not-to-exceed) annual (one-year) rolling averages, updated each hour.
[3] All averaging periods are not-to-exceed values.

6.1 Combustor Operating Parameters

6.1.1 Metals Feedrate

The rule requires limits on maximum SVM and LVM federate, as specified below. Similar to that described for mercury in Section 5, the format of the feedrate limits depends on the basis of the MACT Standard:

- Cement kilns, lightweight aggregate kilns, and liquid fuel boilers burning hazardous waste with a heating value of 10,000 Btu/lb or greater – Feedrate limit on the SVM and LVM thermal concentration in hazardous waste.

- Incinerators, liquid fuel boilers burning hazardous waste with a heating value less than 10,000 Btu/lb, and solid fuel boilers – Feedrate limit on the total mass feedrate from all feedstreams.

Rationale -- The quantity of metal fed to the combustor directly affects emissions of those metals. Specifically, metals emission rates increase with increasing metals feedrates.

For LVM, limits are set on both:

- Pumpable and non-pumpable.

- Pumpable only.

Different limits are set for LVM in pumpable feedstreams because metals in pumpable streams partition at a higher rate to the combustion flue gas (and thus are emitted at a higher rate) than metals in non-pumpable feed streams.

As discussed for Mercury, for SVM limits are only set on the combination of pumpable and non-pumpable, because partitioning between the combustion gas and bottom ash or product does not appear to be strongly affected by the physical state of the feedstream. This is because for typical SVM levels and combustion chamber temperatures, all SVM is predicted to vaporize to the combustion gas.

It was considered, but not selected, to set limits for each different location that wastes are fed (i.e., individual limits for each different waste feed location) because factors affecting metals emissions may vary at the different feed locations.

Limit compliance period and basis -- Identical to that discussed above for Mercury, the SVM and LVM feedrates limit determination and averaging periods are based on the format of the MACT standard:

- Incinerators, cement kiln, lightweight aggregate kilns, solid fuel boilers, LVM for Liquid fuel boilers – (not-to-exceed) 12-hour rolling average period. Limit based on the average of that demonstrated in comprehensive performance testing runs.

- SVM for Liquid fuel boilers – (Not-to-exceed) annual average (updated on a one-hour rolling basis). Determined from the SRE demonstrated in the comprehensive performance test and the HWC MACT limit.

Handling of detection limit measurements -- Consideration of nondetect measurements is similar to that discussed for mercury feedrate limits in Section 5. The one difference is that when complying with the performance test waiver provisions pursuant to §63.1207(m), CKs and LWAKs must assume SVM and LVM are present at the detection limit in the raw material if the feedstream analysis determines that SVM and LVM are present at nondetect levels.

Measurement techniques -- Feedrates are monitored by determining the SVM and LVM concentrations in each feedstream and by determining the flow rate of each feedstream.

Metals analysis methods (digestion and analytical techniques) are outlined in EPA SW-846. Metals analytical techniques are summarized in Table 6-2. The appropriate sample digestion technique (SW-846 Series 3000 Method) is chosen depending on the feedstream phase and analytical method to be used. Alternate (non-SW-846) analytical techniques may be used if demonstrated to have comparable or superior performance; this must be requested in the reviewed and approved comprehensive performance test work plan and feedstream analysis plan.

Feedstream feedrate (solid and liquid) measurement techniques are discussed in Section 10.

Table 6-2. EPA SW-846 Analytical Methods for Metals in Feedstreams

Metal	SW-846 Analytical Method
Low Volatile Metals	
Antimony	6020, 7040, 7041
Arsenic	6020, 7060, 7061
Barium	6010, 6020, 7080
Beryllium	6010, 6020, 7090, 7091
Chromium (total)	6010, 6020, 7190, 7191
Cobolt	6010, 6020, 7200, 7201
Manganese	6010, 6020, 7460, 7461
Nickel	6010, 6020, 7520
Semi Volatile Metals	
Cadmium	6010, 6020, 7130, 7131
Lead	6010, 6020, 7420, 7421
Selenium	6010, 6020, 7740, 7741
High Volatile Metals	
Mercury	7470, 7471

6010 method : atomic emission spectroscopy (inductively coupled plasma)
6020 method : mass spectrometry
7000 series methods : atomic absorption spectroscopy (furnace, flame, hydride, cold vapor)

Characterization requirements during day-to-day compliance operations -- Waste characterization requirements for assuring that SVM and LVM feedrates in all combustor feedstreams during day-to-day operations are below the allowable limit demonstrated in the compliance testing are specified in the facility's feedstream analysis plan. Requirements are identical to those discussed in Section 4 for ash for PM control.

Characterization requirements for natural gas, process air, and vapor recovery system feedstreams -- Requirements are identical to those discussed for mercury in Section 5.

Metals spiking -- The grouping of metals by expected volatility behavior (and resulting partitioning in the combustor system) generally allows for the use of only one metal within each grouping to be used as a surrogate for other metals in the volatility grouping during performance testing (i.e., spiking of combustor feedstreams is only required for one metal in each of the volatility groupings to demonstrate compliance). However, on a site-specific basis, if there is reason to suggest that metals behavior within the volatility group is different (for example, based on previous testing results), individual metal feedrate limits (on individual metals within the same volatility grouping) may be determined to be appropriate. In this situation, individual metal feedrate limits could be avoided by spiking the metal with the worst SRE.

6.1.2 Chlorine Feedrate

An operating limit on maximum chlorine feedrate to the combustion system is required. The limit is based on the total chlorine content in all feedstreams; this includes organic and inorganic chlorine sources.

Rationale -- Chlorine levels may affect metals emissions because chlorinated metal species are more volatile than unchlorinated metals and are thus more difficult to control.

Limit compliance period and basis -- The chlorine feedrate limit is complied with on a 12-hour rolling average period basis, similar to that for the LVM and SVM feedrate limits. The limit is also based on the average of the individual test run averages. Chlorine feedstream analysis requirements are similar to those discussed above for Mercury feedrate control.

Handling of detection limit measurements -- Consideration of nondetect measurements is identical to that discussed for mercury feedrate limits in Section 5.

Measurement techniques -- Chlorine feedrate is monitored by determining the concentration of chlorine in each feedstream, and by determining the flowrate of each feedstream. SW-846 Method 5050 (or ASTM D808) for sample preparation and SW-846 Methods 9250, 9251, 9252, or 9253 for analytical are recommended for chlorine sample analysis. An option for aqueous wastes is to analyze for total organic halogens with SW-846 Methods 9020 or 9022 and inorganic chloride according to the methods discussed above. Other non SW-846 methods may be requested as long as method performance is shown to be comparable or superior to SW-846 methods.

6.1.3 Combustor Gas Flowrate

A limit on maximum combustor gas flowrate is used to ensure that metals entrainment from the combustion chamber in fly ash is minimized, in an identical manner to that used for PM control in Section 4. Limit compliance period, basis, and measurement techniques are identical to that discussed in Sections 4 and 9.

6.1.4 Combustion Chamber Temperature

For the BIF rule (40 CFR Part 266, Subpart H), an operating limit is set on maximum combustion chamber temperature. This is to ensure operation at temperatures that do not lead to enhanced volatilization of metals feeds. Increasing combustion chamber temperature leads to increased metals volatility, which may result in an increase in metals stack gas emissions. Highly volatile metals remain as vapor and may pass uncaptured directly through most air pollution control systems. SVM (and to a small extent some LVM) generally vaporize fully in the combustion chamber and condense fully at lower air pollution control system temperatures either into or onto particles in the sub-micron size range, which is the most difficult to remove in an air pollution control system.

However, further evaluation suggests that although a maximum limit on combustion chamber temperature may make sense for the control of metals emissions based on theoretical considerations and limited laboratory or pilot scale research, in practice it is not considered as necessary because:

- Most metals are typically either highly volatile or highly non-volatile at common combustion temperatures (supported by both theoretical and experimental test evidence). Thus small changes in temperature (as would typically be expected in combustion units) do not impact metals volatility (and resulting stack gas emissions levels).

- Evaluation of trial burn data does not provide any support for a relationship between combustion chamber temperature and stack gas metals emissions levels.

For SVM, in most cases, typical combustion chamber temperatures are high enough so that all of the metals volatilize in the combustion chamber. Thus, increases in temperature beyond typical combustion chamber operating levels will not impact the SVM load to the air pollution control system (and resulting stack gas emissions levels). This is supported by analyses of the trial burn data showing that SVM partitions mostly to the captured particulate matter and dust in the air pollution control system. In general, all SVM vaporizes in the combustion chamber and condenses at the lower operating temperatures of the air pollution control system. This behavior is also supported by theoretical modeling.

LVM would not be expected to vaporize entirely in the combustion chamber. Thus, operating at higher than demonstrated combustion chamber temperature may result in additional metals vaporization and an increase in load (and emissions) to the air pollution control system (as mentioned above, vaporized metals condense on small particles which are difficult to capture in the air pollution control system). However, this is not generally important because the amount of vaporization at typical combustion temperatures, and the amount of additional vaporization at higher than typical temperatures, is usually negligible compared to the amount of LVM contained in non-volatilized entrained flue gas particulate matter, which is present at particularly high levels in cement kilns, aggregate kilns, fluidized and rotary kiln incinerators, and pulverized coal boilers.

Analyses of trial burn data does not indicate a strong relationship between combustion chamber temperature and LVM (or SVM or mercury) stack gas emissions. Note that this may be due to the difficulty in observing trends from data taken from a number of facilities; there is a considerable amount of variance from one facility to another due to differences in control devices, feed rates, operating parameters, and measurement techniques. These effects of facility specific differences may obscure trends due to a single parameter. In particular, combustion chamber temperature is difficult to accurately measure, especially from cement and lightweight aggregate kilns. Temperature measurements are taken at different locations with different instruments, making it difficult to compare results from different facilities. In any case, the fact that there is not a strong relationship between combustion chamber temperature and metals stack gas emissions (LVM as well as SVM or mercury) implies that other parameters besides combustion chamber temperature are more dominant in influencing stack gas emissions levels.

Additionally, the requirement of a maximum temperature limit is in conflict with demonstration of operation at a minimum temperature limit for adequate organics destruction. Thus the addition of a maximum combustion chamber temperature limit would increase the testing condition requirements (and thus costs and complexity) of the comprehensive compliance testing program.

Also note that prolonged operation at maximum temperature during the comprehensive performance test (and normal operations) is not desirable because it can be destructive to the kiln refractory.

Note that under strictly theoretical considerations, it has been shown that for particular cases, higher combustion chamber temperatures should lead to increased metals emissions (for instance, certain SVM at very high feedrates where complete vapor saturation is predicted to occur). But as discussed above, actual emissions data have not shown a strong trend which supports this theory.

6.2 Air Pollution Control Devices

PM air pollution control device type and associated control parameters discussed in the PM compliance Section 4 are also equally applicable to SVM and LVM control. Additionally, the operating temperature of the air pollution control device or system may be particularly important to SVM control. Specialized sorbent specifically designed for metals control may also be used.

Operating temperature of air pollution control device -- For metals which volatilize in the combustion chamber and are carried out with the flue gas, the temperature of the particulate matter control device influences the subsequent degree of condensation and control (lower temperature results in a higher degree of condensation and control). Thus, a maximum temperature limit is required for dry APCDs to help to ensure that these types of metals emissions are being adequately controlled. The maximum limit is based on a 1-hour rolling average period. It is determined on the average of the individual test run averages from the comprehensive performance testing. For wet scrubbers, which operate at lower dew point saturation temperatures, a maximum temperature limit is not required.

Note that a maximum control device temperature limit is also used to control PCDD/PCDF formation for particular classes of sources (e.g., liquid fuel boilers equipped with dry particulate matter control devices). The applicable resulting limit is the minimum of the maximum limits as determined by the PCDD/PCDF and metals testing in cases where compliance with these standards are conducted under separate performance test conditions.

Metal capturing sorbents -- Sorbents such as kaolin, bauxite, silica, alumina, and clays, are currently being developed to control semivolatile metals emissions. No hazardous waste burning facilities are currently intentionally using these control techniques, however they may in the future. The sorbents can be added directly to the feed, or injected separately downstream of the combustor. Operating parameter requirements may be analogous to carbon injection and dry scrubbing technologies discussed in other Sections. In site-specific cases where waste and other feedstream materials may potentially contain these types of metal capturing ingredients, monitoring of waste composition during the comprehensive performance testing (and during subsequent regular operation) may be appropriate in cases where it might be expected that composition of wastes and/or feed materials are likely to significantly change.

6.3 Extrapolation

The "upward" extrapolation of SVM and LVM feedrates and associated emissions rates from levels demonstrated during the comprehensive performance test to higher allowable feedrate and emissions rates can be requested on a site-specific basis. Linear upward extrapolation from the "origin" (at a metal feed and emissions rate of zero) can be conservatively used to allow for higher metals feedrate limits while continuing to ensure that the facility is within the MACT emissions limits.[10] This is because metals system removal efficiencies tend to stay the same or increase as the feedrate increases. This has been shown based on theory and statistical analysis of experimental test results. This applies to all metals types and volatility groupings.

The conservative nature of the "upward" extrapolation procedure is shown in Figure 6-1. The emissions level predicted at a higher feedrate based on linear extrapolation through the origin and from measured emissions levels at a lower feedrate is greater than or equal to the actual emissions levels at the higher feedrate (based on the expected relationship between metals feed and emissions rates). Alternatively, because "downward" extrapolation may not always be conservative, as also shown in Figure 6-1, it is generally not allowed.

Downward extrapolation is permitted for normal emissions-based standards (see Section 2 and Appendix B)

A request for the use of extrapolation for setting allowable metals feedrate limits must be contained in the comprehensive performance test plan, which is submitted to EPA at least 1 year

---

[10] We note that allowing upward extrapolation of performance test feedrates to establish feedrate limits (while ensuring that the emission standard would not be exceeded) precludes the need for sources to spike toxic metals excessively during performance testing to achieve feedrates at the high-end of normal operations. Spiking toxic metals poses a health risk to workers, increases the environmental loading of toxic metals, and increases the cost of performance testing.

prior to the actual testing. The extrapolation methodology will be reviewed and approved by the Agency. The extrapolation submittal must discuss:

- Rationale for the selection of the comprehensive performance test metals feedrates, and desired extrapolated feedrates. In particular, the feedrate levels must at a minimum represent those in typical "normal" waste streams. It should also reflect the potential variability and fluctuation in normal waste metals levels, which will depend on the heterogeneity and other characteristics of the waste. The discussion should include a listing of the various waste streams that are treated, and results of historical metals characterization efforts. This is to ensure that the amount of extrapolation that is needed is minimized.

- Rationale for the selection of the physical form and species of the metals used, also based on expected waste characteristics.

- A maximum extrapolated feedrate that would be desired, again considering the historical metal feedrate data. Specifically, EPA does not want sources to extrapolate to allowable feedrates that are significantly higher than their historical range of feedrates. The requested extrapolated feedrates should be limited to the upper end of historical metals feedrate ranges that a source has actually fed, unless the source documents that future operations will necessitate higher metals feedrate limits.

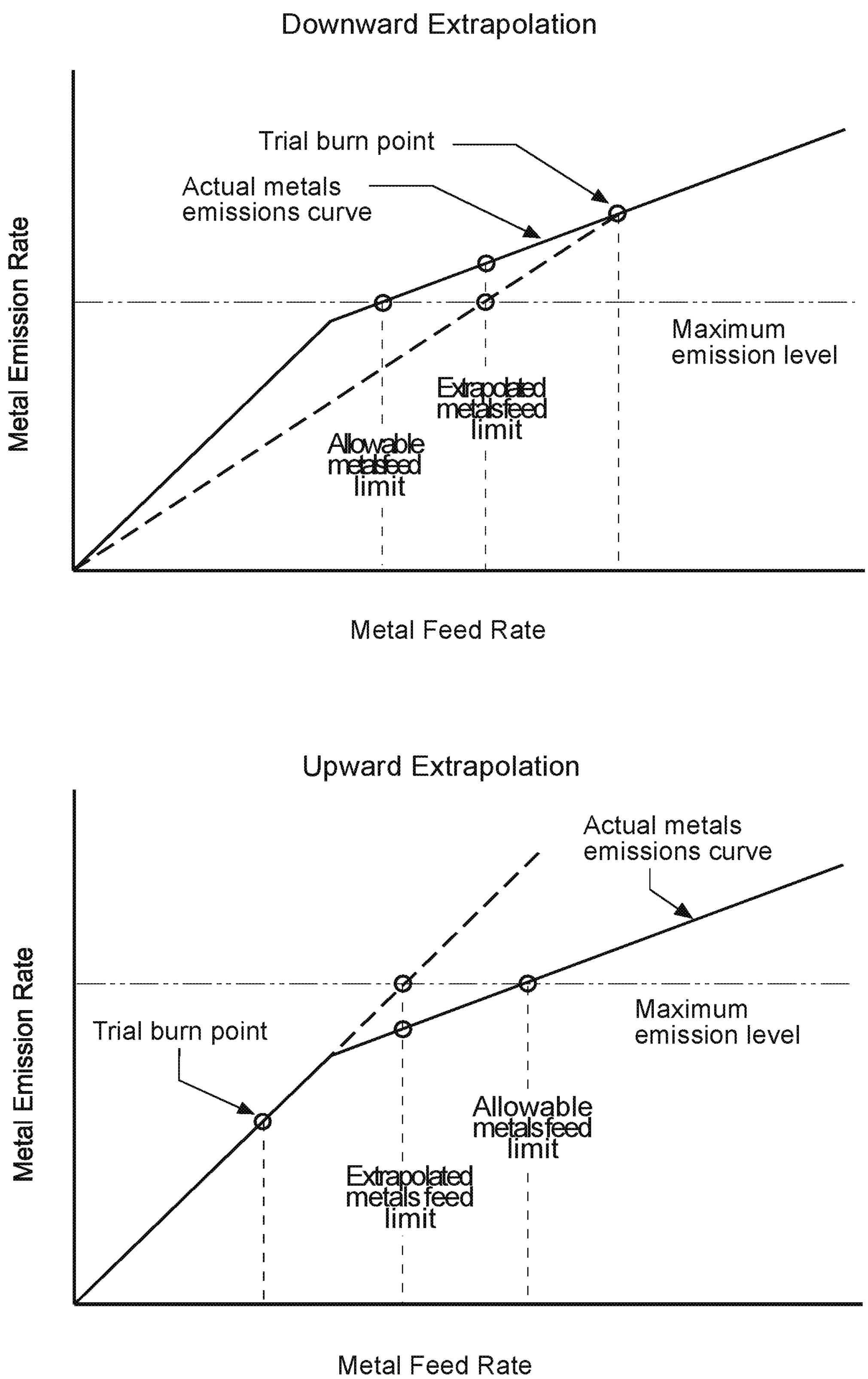


Figure 6-1. Basis for metal feedrate extrapolation guidance.

- Discussion of characterization procedures to be used to ensure that metals feedratesand emissions rates documented in the comprehensive performance test plan are highly accurate. Some spiking will likely be required to increase confidence in the measured feedrate levels used to project higher allowable feedrate limits. Errors associated with sampling and analyzing heterogeneous waste streams can be minimized by spiking known quantities.

Also, after the performance testing, the Agency will review the testing and extrapolation results to confirm that they have been interpreted properly and that the extrapolation procedure is appropriate for the source.

The extrapolation procedure that is to be used will depend on the extent and quality of the metals feedrate and emissions data. To ensure that the extrapolation is "conservative" in nature (i.e., produces projected emissions levels at the projected feedrate that are upper bounds on that expected), it is recommended that the extrapolation be based on either the lowest SRE within a test condition, or some statistically based analysis procedure. This might include:

- For cases where a large amount of data has been compiled from different feedrate levels (for example, through many tests over the years), extrapolation from a statistically based analysis of the specific facility data may be appropriate, such as from a worst case test condition average considering typical statistical variability of the within-test condition runs, or a linear regression of the condition average (or individual run) feedrate and emissions rate data, considering some upper confidence limit bound.

- For cases where more limited and/or widely spread data are available, extrapolation from the worst case lowest observed SRE that is not an outlier.

- Extrapolation from a single test burn condition based on determination of the "Upper Confidence Limit". Specifically, this involves using a single test condition average, and a "within test condition" standard deviation based on either site specific data or the demonstrated variation observed in other similar type tests.

- For small extrapolations to feedrates relatively close to demonstration testing levels, more aggressive extrapolations may be warranted, such as those from a test condition median or average. Alternately, for larger extrapolations, a more conservative procedure is generally appropriate.

7.0 Chlorine

System operating parameter monitoring and control options for assuring continuous control of chlorine emissions are discussed, including limits on: (1) combustor operating parameters including feedstream chlorine and caustic feedrates; and (2) chlorine air pollution control device (e.g., dry and wet scrubbers) operating parameters. Operating parameter requirements for assuring control of chlorine are summarized in Table 7-1.

Alternatively and preferably, both hydrogen chloride (HCl) and chlorine gas (Cl_2) (or possibly HCl alone in certain cases) continuous emissions monitors may be used as a direct indicator of total chlorine emissions, as discussed in Section 13.

Table 7-1. Total Chlorine Monitoring Requirements

Control Technique	Compliance Using	Limits From	Averaging Period[1]	How Limit Is Established
Limit on Maximum Chlorine Feedrate[1]	Sampling and analysis of feedstreams[1] for chlorine (organic and inorganic) and a continuous monitoring system (CMS) for feedstream flowrate	Comprehensive performance test	12-hour	Avg of the test run averages
Wet Scrubber	CMS for maximum flue gas flowrate or kiln production rate	Comprehensive performance test	1-hour	Avg of the maximum hourly rolling averages for each run
	High energy scrubbers: CMS for minimum pressure drop across scrubber	Comprehensive performance test	1-hour	Avg of the test run averages
	Low energy scrubbers: CMS for minimum pressure drop across scrubber	Manufacturer specifications	1-hour	n/a

	Low energy scrubbers: CMS for minimum liquid feed pressure	Manufacturer specifications	1-hour	n/a
	CMS for minimum liquid pH	Comprehensive performance test	1-hour	Avg of the test run averages
	CMS for limit on minimum scrubber liquid flowrate or CMS for limit on minimum liquid/gas ratio	Comprehensive performance test	1-hour	Avg of the test run averages
Dry Scrubber[2]	CMS for minimum sorbent feedrate	Comprehensive performance test	1-hour	Avg of the test run averages
	CMS for minimum carrier fluid flowrate or nozzle pressure drop	Manufacturer specification	1-hour	n/a
	Identification of sorbent brand and type or adsorption properties	Comprehensive performance test	n/a	Same properties based on manufacturer's specifications

[1] All averaging periods are not-to-exceed values.

[1] For incinerators, cement kilns, lightweight aggregate kilns, liquid fuel boilers feeding waste with a heating value less than 10,000 Btu/lb, and solid fuel boilers, the limit is expressed in total mass feedrate, and is based on the sum of all feedstreams (except natural gas, process air, and feedstreams from vapor recovery systems). For liquid fuel boilers feeding waste with a heating value of 10,000 Btu/lb or greater, the limit is expressed as a thermal concentration in the hazardous waste, and applies only to hazardous waste contributions. Not applicable for HCl Production Furnaces.

[2] A CMS for gas flowrate or kiln production rate is also required with the same provisions as required for that compliance parameter for wet scrubbers.

7.1 Combustor Operating Parameters

Chlorine feedrate -- Chlorine emissions rates generally increase with increasing chlorine feedrate. Thus a limit on the maximum feedrate of chlorine is required for all sources except

HCl production furnaces. Similar to that discussed above for mercury and SVM/LVM, the format of the chlorine feedrate limit depends on the basis of the MACT standard:

- Incinerators, cement kilns, LWAKs, solid fuel boilers, and liquid fuel boilers that feed low energy waste (heating value <10,000 Btu/lb). A maximum total feedrate limit considering all feedstreams.

- Liquid fuel boilers that feed high energy waste (heating value greater than or equal to 10,000 Btu/lb) – A maximum limit on the hazardous waste thermal concentration.

- HCl production furnaces – No chlorine feedrate limit.

Feedrate limit averaging is required on a 12-hour rolling average period. The limit is based on the average of the individual comprehensive performance test run averages from each run of the pertinent test condition. Feedstream chlorine and feedrate measurement methods and requirements are similar to those discussed previously in Section 4 (PM (ash)) and Sections 5 and 6 (Hg and LVM/SVM).

Caustic feedrate -- Certain feed constituents may act to control chlorine flue gas emissions (e.g., feed content of caustics such as calcium, sodium, or potassium). Thus a limit on the minimum feedrate of these chlorine controlling parameters may be appropriate. However, this limit is not recommended in general because in practice, chlorine control is primarily based on chlorine feedrate control and the use of an air pollution control device. In site-specific cases where it is determined that the waste and/or other feedstream compositions can significantly influence chlorine control, and they may be expected to vary, this limit may be appropriate. Note that although limits are not generally set on caustic feedrates in feedstreams to the combustor, as discussed below, limits are established on caustic feedrates to air pollution control devices used for chlorine control.

7.2 Air Pollution Control Devices

7.2.1 Dry and Spray Dryer Scrubbers

Dry and spray-dry scrubbing performance is impacted primarily by caustic feedrate, parameters influencing caustic-to-gas mixing, caustic type and specifications, and temperature at location of injection.

Caustic feed rate -- A limit on minimum caustic injection rate is required.

Rationale -- Increased levels of caustic injection lead to increased levels of acid gas control. Ideally compliance should be based on maintaining a minimum ratio of the caustic to that of the flue gas acid content (including HCl, HF, SO_2, etc.). However this is not possible without either very detailed and accurate waste knowledge or a continuous HCl (and SO_2) monitor. Thus, to be conservative, and ensure that adequate chlorine control is being achieved (similar to that demonstrated in the successful comprehensive performance test), a limit on minimum caustic injection rate is set.

Note that the injection rate refers to the instantaneous feed of caustic that is being sprayed into the flue gas duct or dedicated dry scrubbing vessel. It does not refer to the potential batch addition of caustic into the caustic holding silo vessels.

Limit compliance period and basis -- The minimum limit is based on a (not-to-exceed) 1-hour rolling average period. It is set based on the average of the individual test run averages of the comprehensive performance test demonstrations.

Measurement techniques -- Feedrate measurement techniques are similar to those discussed in Section 3 for carbon injection.

Caustic type and specifications -- Caustic specifications such as chemical properties (e.g., composition, use of additives or enhancers) and physical properties (e.g., particle size, specific surface area, pore size) can significantly affect performance. Thus, the caustic that is used in continuing everyday operations must be shown to have similar or superior performance characteristics compared with that used in the comprehensive performance test.

One compliance option is to limit the brand and type of caustic used during everyday operations to exactly what was used in the comprehensive compliance testing demonstration.

Alternatively, it may be desired to have flexibility in using different brands and/or types of caustic in everyday operation compared with that used in comprehensive compliance testing. If this is required, the comprehensive performance test plan must document appropriate performance characteristics of the caustic that is used in the performance test. These proposed characteristics will be reviewed and approved as part of the comprehensive performance test plan approval by the appropriate Agencies. These characteristics will be used as the basis for caustic-type changes. The source must document in the written operating record that the caustic that is being used is adequate (i.e., that it meets the specifications of that used in the compliance testing). For caustics that are significantly different from that used in the performance testing (such as caustics from a new source or vendor) limited retesting and/or information submittals to demonstrate the performance capabilities of the new caustic may be needed. Note that these requirements are identical to those discussed for carbon adsorption and inhibitors in Section 3 (which discusses requirements for PCDD/PCDF control operating parameters).

Carrier flowrate or nozzle pressure drop -- A limit on minimum caustic carrier flowrate is required. Caustic injection nozzle pressure drop may also be used as an indicator of adequate carrier gas flowrate.

Rationale -- Caustic particles need to be properly fluidized in the transfer lines so that they do not agglomerate prior to injection. Also, caustic must be injected with adequate force to ensure proper flue gas duct coverage (sufficient caustic penetration into the flue gas).

Limit compliance period and basis -- The limit is set on a (not-to-exceed) 1-hour rolling average period. The limit is set based on system/equipment designer and/or manufacturer specifications.

Measurement techniques -- Measurement techniques for flowrate and pressure drop are discussed in Sections 3 and 9.

Caustic injection temperature -- Caustic capture efficiency of acid gases is a function of flue gas temperature at injection location, as well as the temperature of the APCD used to capture the used caustic. Capture efficiency tends to increase with decreasing temperature. A limit on maximum air pollution control device temperature, set for both metals and PCDD/PCDF control purposes, is sufficient to ensure this parameter is within an adequate range.

Caustic recycling rate -- "Used" caustic (injected and caught in a particulate matter control device) may be recycled for additional use back into the process. For these system arrangements, it may be appropriate to set a limit on the maximum caustic reuse rate or the minimum new fresh caustic addition rate, similar to that discussed for carbon injection in Section 3.

7.2.2 Wet Scrubbers

As discussed in Section 4 for PM control, wet scrubbers that are used for chlorine control are generally of two main types:

- "Low energy" wet scrubbers that are highly effective for controlling chlorine emissions include types such as packed beds (including "ionizing" wet scrubbers), plate tray, and "froth" scrubbers. Also crude scrubbers such as spray ("rain") towers are also used when less efficient control is adequate. These scrubbers operate by contacting the flue gas with the scrubber liquid stream.

- "High energy" wet scrubbers such as venturi, collision, and free-jet types can efficiently control chlorine, as well as PM. These scrubbers rely on atomized liquid droplets to collect and control PM and acid gases.

For acid gas control, general wet scrubber parameters, including scrubber liquid pH, liquid-to-gas ratio, scrubber pressure drop, and liquid feed pressure, may be used for assuring control device performance. Note that specific requirements for low and high energy scrubbers are differentiated when appropriate. When not mentioned, requirements apply to both low and high energy scrubbers.

Liquid pH -- A limit on the minimum pH of the scrubber liquid, at either the scrubber inlet or the scrubber outlet, is required for all types of wet scrubbers.

Rationale -- At lower pH levels (more acidic), scrubbing liquids have decreased acid gas solubility (especially for Cl_2). This adversely affects chlorine capture performance. Additionally, the pH should be maintained to assure that the scrubbing liquid has adequate capacity to remove acid gases (i.e., the pH of the scrubber liquor should be limited to assure that the scrubber is not being overloaded with acid). Effluent liquid pH level information can also be used for effective handling of the waste liquid. The pH is controlled by addition of caustic materials to the liquid prior to introduction into the scrubber unit or by increasing liquid blowdown (with a corresponding increase in liquid fresh makeup water).

Limit compliance period and basis -- The minimum limit is complied with on a (not-to-exceed) 1-hour rolling average period basis. It is set based on the average of the individual test condition averages from the comprehensive performance test demonstration.

Measurement techniques -- The pH is monitored with a continuous liquid pH meter.

Liquid-to-gas ratio -- A limit on minimum liquid-to-gas ratio is required for all scrubber types.

Rationale -- A limit on liquid-to-gas ratio is set is to ensure proper wetting of scrubber internal packings or trays and/or to facilitate sufficient liquid and gas contacting. Liquid-to-gas ratio is maintained by adjusting the liquid injection rate and/or flue gas flowrate.

Limit compliance period and basis -- The minimum limit is set on a (not-to-exceed) 1-hour rolling period. It is based on the average of the individual test run averages from the comprehensive performance test demonstrations

Note that for this and other "normalized" parameters which are a function of two independent operating parameters (not measured directly by one measurement technique), it may be adequate to set and comply with individual limits on each parameter, and not the ratio. Specifically, the flue gas flowrate is limited to a maximum level for various other purposes. Thus, a single limit on the minimum liquid flowrate is adequate as long a corresponding maximum limit is met on the flue gas flowrate through the scrubber. The liquid-to-gas ratio will always be higher than the performance test level as long as both a minimum liquid rate and maximum gas flow rate are being maintained because both increased liquid flow rate and decreased gas flow rates will result in a higher liquid-to-gas ratio.

Measurement techniques -- Liquid-to-gas ratio is determined by measurement of liquid injection rate and flue gas flowrate. Measurement techniques for both of these parameters are discussed in Section 9.

Pressure drop -- Pressure drop requirements are based on determination of whether the scrubber is considered as high or low energy design, as discussed above and in Section 4.

High energy scrubbers -- Pressure drop across "high energy" scrubber types is important in assuring scrubber performance. Increasing pressure drop for high energy scrubbers corresponds to increasing control performance, as discussed for wet scrubbers in the PM control Section 4. Averaging time (not-to-exceed 1-hour rolling average), basis (average of comprehensive performance test run averages), and monitoring methods are discussed in Section 4.

Low energy scrubbers -- For many "low energy" scrubbers, pressure drop is not generally a significant indicator of system performance. For example, for systems such as spray towers without internal packings or trays, pressure drop across the device is not expected to vary, and has little to no impact on performance. Alternatively, for packed beds and tray type scrubbers, pressure drop may be a secondary indicator of system performance, indicative to some degree of gas/liquid mixing. Thus, generally, for low energy wet scrubbers, a limit on minimum wet scrubber pressure drop is set based on manufacturer specifications. The limit must be included in a reviewed and approved performance test plan. It is complied with on a 1-hour rolling average period. A limit may not be appropriate for certain site-specific scrubber designs and arrangements. In these cases, the source may petition the Agency under §63.1209(g) for a waiver to the pressure drop limit.

Liquid feed pressure -- Liquid feed pressure requirements are based on scrubber system design and operation. Liquid feed pressure is required for those scrubbers which rely on liquid feed pressure for atomization of scrubber liquid, and effective chlorine control.

Low energy scrubbers -- A minimum limit on liquid feed pressure is required for low energy scrubbers. The limit is based on a (not-to-exceed) 1-hour rolling average, and set from manufacturer/designer specifications as specified in an Agency reviewed and approved test plan. This limit is especially appropriate for scrubbers such as spray towers. For certain low energy designs, such as packed bed scrubbers, this limit may not be appropriate. For these cases, the source can petition to waive the liquid feed pressure requirement under §63.1209(g).

High energy scrubbers -- A minimum liquid feed pressure is not required for most high energy scrubbers. For certain scrubber designs, on a site-specific basis, the permitting official may require a limit under §63.1209(g) when it is determined to be important to scrubber liquid atomization and acid gas control.

8.0 Nondioxin Organics

Nondioxin organic HAPs have been shown to contribute a significant proportion of the total cancer risk for some receptors in at least one site specific risk assessment. Nondioxin organic HAPs can be emitted as partial breakdown byproducts of incomplete combustion (PICs) or as undestroyed HAPs fed to the combustor. In order to minimize PIC emissions, the HWC MACT standards set limits on emissions of CO and/or HCs to ensure good combustion.

8.1 CO and Hydrocarbons

CO and HC flue gas levels are direct, continuously monitorable indicators of combustion efficiency and combustor performance. Emissions of CO, HC and other organics are minimized when good mixing is achieved between the air and the fuel/organic waste and when temperatures sufficient to maintain combustion are encountered. Conversely, when mixing begins to deteriorate or when temperatures begin to go below those necessary to support complete combustion, emissions of CO will begin to rise, followed eventually by a rise in emissions of HC and other organics if the combustion conditions continue to deteriorate. Thus, CO is considered an advance indicator for organics emissions and HC is considered a direct indicator for organics emissions. In some circumstances (e.g., when waste is injected at a location where it bypasses the flame entirely or in the event of a total ignition failure) high HC/organic emissions may occur without accompanying high CO emissions.

A source can choose to comply with either CO or hydrocarbon (HC) limits. These limits are specified in the standards; they are not set on the basis of performance testing. They must be complied with on an (not-to-exceed) hourly rolling average basis (see Section 2.2.2). They must be reported on a dry volume basis, corrected to 7% O_2. If the measurement is made on a wet basis (for example, when measuring HC using a heated FID), then a moisture correction must be made. Although the moisture correction must be done continuously, the measurement of moisture (which must be done by monitoring for moisture using the methodology of 40 CFR Part 60, Appendix A, Method 4) can be performed continuously or it can be performed once during the comprehensive performance test and annually thereafter. The oxygen correction is made according to the following formula:

$$P_c = P_m \times 14/(E - Y)$$

where:

P_c = concentration of the pollutant or standard corrected to 7 percent oxygen;
P_m = measured concentration of the pollutant;
E = volume percentage of oxygen in the combustion air fed into the device, on a dry basis (normally 21 if only air is fed);

Y = measured percentage of oxygen on a dry basis at the sampling point.

The term 14/(E-Y) above is the oxygen correction factor. As excess air or dilution air in the sample increases, Y (the measured percentage of oxygen at the sampling point) increases and the oxygen correction factor increases. High oxygen correction factors tend to decrease the sensitivity of the CO or HC monitor and increase the uncertainty of the measurement. For example, samples taken in the bypass duct of a cement kiln generally have high oxygen correction factors with correspondingly low sensitivities. This can be countered by spanning the instrument at a value proportionally lower than that required in the performance specification such that the site-specific span value should be the specified span value times the reciprocal of the oxygen correction factor. The rule requires such site-specific spans to be performed if the source normally has an oxygen correction factor greater than 2.

In extremely high excess air/dilution situations, as the measured oxygen approaches that of the combustion air (as Y approaches E in the above equation) the oxygen correction factor gets very large and can be inaccurate. One common situation where this may occur is startup/shutdown. In order to avoid this situation, sources must identify in their Startup Shutdown, and Malfunction Plan a projected oxygen correction factor to use during periods of startup and shutdown.

CO must be measured with a continuous monitor which meets 40 CFR Part 60, Appendix B Performance Specification 4B. HC must be measured with a continuous monitor which meets 40 CFR Part 60, Appendix B Performance Specification 8A. It must be reported as volume concentration equivalents of propane. O_2 (needed for oxygen correction) must be measured with a continuous monitor which meets 40 CFR Part 60, Appendix B Performance Specification 4B.

Performance specification 4B requires the CO monitor(s) to be spanned over two ranges (0 - 200 ppm and 0 - 3,000 ppmv). Performance Specification 8A requires the HC monitor(s) to be spanned over one range (0 - 100 ppmv). One-minute CO averages which exceed the span of the instrument must be reported as 10,000 ppmv, and one-minute HC averages which exceed the span of the instrument must be reported as 500 ppmv. This is to ensure that temporary upsets (for example, as may occur in poorly managed batch-fed operations) which result in CO/HC spikes which exceed the span range of the instrument are fully and conservatively accounted for in calculation of rolling averages, and that a source does not avoid an automatic waste feed cutoff and does not come back into compliance and resume feeding waste too quickly after an AWFCO due to under-reported CO/HC spikes. Sources have an option of adding a third span range for CO monitors (0 - 10,000 ppmv) and/or a second span range for HC monitors (0 - 500 ppm). For example, if the one-minute-average CO concentration was 4,000 ppm, a source using the Method 4B high span range of 0 - 3,000 would measure an out-of span value and would be required to record the concentration as 10,000 ppmv; whereas a source using the optional 0 - 10,000 ppmv high span range would be able to measure and record the concentration as 4,000 ppmv.

Because HC is considered a more direct indicator than CO for organics emissions (CO serving as an "early warning system"), and because it is possible in some circumstances (e.g., when waste is injected at a location where it bypasses the flame entirely or in the event of a total ignition failure[11]) that high HC/organic emissions may occur without accompanying high CO emissions, sources which choose to comply with the CO limit, must also demonstrate in their comprehensive performance test that they also comply with the HC limit and must comply with operating limits associated with "good combustion practice" (see Section 9) set on the basis of that performance test.

8.2 Parameters for Batch Feed Operations

Batch-feeding (i.e., feeding containers, charges, or portions of charges discreetly to a combustor), if done improperly, can deplete the available oxygen in a combustor, potentially leading to increased emissions of CO, HC, and organic HAPs (including PCDD/PCDF). In previous efforts, EPA has proposed to set limits on certain parameters (maximum batch size, minimum batch feed interval, and minimum combustion zone oxygen concentration prior to charging) for batch feeding operations in order to prevent overcharging. In agreement with many commenters, it is concluded that compliance with the CO or HC standard is sufficient to ensure that good combustion occurs in batch feed operations. Thus, the proposed rule does not set limits on the above-mentioned batch-related parameters.

However, there is concern that carbon monoxide or hydrocarbon monitoring may not be adequate to ensure that good combustion practice will be maintained and that emissions standards will be met for all batch feed operations. Because oxygen depletion can occur very rapidly due to batch overcharging, when CO or HC begin to approach the standard it may be too late to apply corrective action. To address this concern, regulatory officials can impose additional operating parameter limits that may affect batch feeding operations for a specific site either using discretionary authority provided by §63.1209(g)(2) or through an enforcement action. It is anticipated that permitting officials will determine on a site-specific basis, typically during review of the initial comprehensive performance test plan and subsequent review of the comprehensive performance test results, whether limits on one or more batch feed operating parameters need to be established to ensure good combustion practices are maintained. This review should consider previous compliance history (e.g., frequency of automatic waste feed cutoffs attributable to batch feed operations that resulted in an exceedance of an operating limit or standard under RCRA regulations prior to the compliance date), together with the design and operating features of the combustor. To assist in this review, it is anticipated that permitting officials will require sources (through review and approval of the test plan) to simulate worst-case batch feed operating conditions (e.g., lowest oxygen levels, largest batch size and/or highest Btu content, highest waste volatility, highest batch feeding frequency) during the comprehensive performance test when demonstrating compliance with the PCDD/PCDF and destruction and removal efficiency standards.

[11] In the unlikely event of a total ignition failure one would observe a rapid decline in combustion zone temperature

After the MACT compliance date, permitting officials will likely become aware of inefficient or unstable batch feeding operations, since a source is required to submit a report to the Agency if it exceeds any of its operating parameter limits (such as the CO or HC standard) more than 10 times in a 60 day period. It is anticipated that permitting officials will take the opportunity to review batch feed operations and, if it is determined that batch feed operations do contribute to the frequency of exceedances, will use the authority under §63.1209(g)(2) to establish batch feed operating parameter limits.

To ensure that HC/CO spikes are fully accounted for, even in the event that the span value is exceeded, the final rule requires that HC and CO monitor measurements that exceed the span for any one-minute period are assumed to be (and tallied into the rolling average as) 500 and 10,000 ppmv, respectively. Note that the Method 8A span value of the HC CEMS is 100 ppmv and the Method 4B span value of the CO CEMS is 3,000 ppmv, although a source may elect to continuously monitor HC/CO over an expanded range.

9.0 Destruction and Removal Efficiency

To control emissions of organic HAP, a source must comply with operating limits established under conditions demonstrated to result in a DRE of at least 99.99% (99.9999% for sources burning listed dioxin-contaminated or PCB-contaminated wastes). DRE is defined as:

$$DRE = [1 - (W_{out} / W_{in})] \times 100\%$$

where:

W_{in} = mass feedrate of a principal organic hazardous constituent (POHC) in a waste feedstream

W_{out} = mass emission rate of the same POHC present in exhaust emissions prior to release to the atmosphere

One or more POHCs must be selected from the list of hazardous air pollutants established by 42 U.S.C. 7412(b)(1), excluding caprolactam. POHC selection should be based on the degree of difficulty of incineration of the organic constituents in the waste and on their concentration or mass in the waste feed, considering the results of waste analyses or other data and information.

With the exception of sources that feed hazardous waste at a location in the combustion system other than the normal flame zone and sources that modify their operations such that DRE is affected, the DRE test only has to be conducted (and the resulting operating limits only have to be set) one time, provided the source has not changed design, operation, and/or maintenance practices in a way that may adversely affect its ability to achieve the DRE standard. It can be taken from a previous compliance test that met sufficient quality assurance objectives (so long as the appropriate measurements were taken and the standards were met), or it can be conducted during the initial comprehensive performance test. Sources that feed hazardous waste at a location in the combustion system other than the normal flame zone must conduct a DRE test at every comprehensive performance test.

The following operating parameters are associated with "good combustion practice" and have limits established in the DRE test:

- Minimum combustion chamber temperature.
- Maximum flue gas flowrate or production rate.
- Maximum hazardous waste feedrate.
- Operation of waste firing system.

These parameters are also dioxin-related parameters for which limits must be set in the comprehensive performance test. If the DRE test is conducted separately from the comprehensive performance test, the more stringent limits take precedence. To avoid ratcheting down from previously established limits, it is allowed to exceed existing limits for DRE-related parameters in subsequent comprehensive performance tests.

Minimum combustion chamber temperature. A minimum combustion chamber temperature limit is established for each combustion chamber. For cement kilns and lightweight aggregate kilns, separate temperature limits apply at each location where hazardous waste may be fired (e.g., the hot end of a cement kiln where clinker is discharged; mid kiln; calciner; etc.). However, recognizing that it is difficult to measure mid-kiln temperatures, kilns which fire hazardous waste at that location may use the back-end temperature as a surrogate.

Rationale -- The rate of organics destruction decreases with decreasing temperature. A minimum temperature limit is established to ensure that the destruction and removal efficiency demonstrated in the DRE test is maintained in continuing operation.

Limit compliance period -- One-hour rolling average minimum limits are set. Rationale for the averaging period is discussed in Section 2 of this document.

Limit basis -- The (not-to-exceed) hourly rolling average limit is set based on conditions demonstrated during the DRE test. It is set as the average of the average temperature measured in each DRE-test run. For compliance, the hourly rolling average temperature may not go below its limit.

Measurement techniques -- The combustion chamber temperature measurement should be made at a location that best represents, as practicable, the bulk gas temperature in the combustion zone of that chamber. This may require some site-specific considerations, so the rule requires that the temperature measurement location be identified in the test plan and subject to approval as part of the test plan.

Combustion gas temperature is usually measured with thermocouples that are shielded from radiation sources. Calibrated optical or infrared pyrometers (which measure the temperature or radiating materials such as flames or burning beds) are also used and can be effective if the gas temperature is closely related to the temperatures of the radiating materials. It is difficult to reliably measure the combustion zone temperature, especially in some high temperature industrial kilns. Thus another sampling location within the combustion chamber can be used as an indicator of combustion zone temperature; this location must be identified in the approved test plan and must be chosen to best represent the bulk gas temperature in the combustion zone. Errors in temperature measurement can be caused by insufficient heat transfer surface, radiation from the flame, or radiation from the incinerator walls.

Temperature can be controlled by adjusting the waste feedrate, using auxiliary fuel, or by adjusting the feedrate of air or oxygen.

Maximum flue gas flowrate or production rate. A maximum limit is established for flue gas flowrate, or on another parameter (e.g., production rate) documented in the approved site-specific test plan as an appropriate surrogate for gas residence time.

Rationale -- The extent of organics destruction increases with increasing residence time. Residence time is inversely proportional to gas flowrate. A minimum flue gas flowrate limit is established to ensure that the destruction and removal efficiency demonstrated in the DRE test is maintained in continuing operation. This limit also serves to ensure that air pollution control equipment is not overloaded, leading to increases in the emissions of various HAPs.

Limit compliance period -- An (not-to-exceed) hourly rolling average limit is established on the maximum flue gas flowrate. Rationale for the use of this averaging period is discussed in Section 2 of this document.

Limit basis -- The limit is set based on conditions demonstrated during the DRE test. The hourly rolling average limit is set as the average over all runs of the maximum one-hour rolling average for each run. For compliance, the hourly rolling average flue gas flowrate (or surrogate) may not go below its limit.

Measurement techniques -- Flue gas flowrate can be monitored with a direct gas flowrate monitor at either the outlet of the last combustion chamber or at the stack. At the outlet of the combustion chamber, there are potential measurement problems due to high temperature, high flue gas acidity, and high particulate loading. At the stack there may be problems due to air infiltration or gas moisture content. Direct measurement techniques include pitot tube, thermal conductivity indicator, sonic flow indicator, rotating disk, or flow constrictor (e.g., baffle plate, venturi, or orifice plate) methods. Flue gas flowrate can also be measured indirectly by combustion air flowrate (not possible for induced draft combustors).

Depending on the type of system, production rate could be indicated by measurement of parameters such as raw materials feed rate, thermal input, steam production rate (for boilers), or clinker production rate (for cement kilns). The parameter selected must directly correlate with flue gas flowrate.

<u>Maximum hazardous waste feedrate</u>. A limit is established on the maximum hazardous waste feedrate limit for pumpable and nonpumpable wastes. For incinerators, hazardous waste feedrate limits must be established for each combustion chamber. For cement kilns and lightweight aggregate kilns, hazardous waste feedrate limits must be established for each location where waste is fed (e.g., the hot end where clinker is discharged; mid-kiln; and/or the preheater/precalciner of a cement kiln).

Rationale -- An increase in waste feedrate without a corresponding increase in combustion air can cause inefficient combustion that may lead to incomplete destruction of organic hazardous air pollutants. A maximum hazardous waste feedrate limit is established to ensure that the destruction and removal efficiency demonstrated in the DRE test is maintained in continuing operation. Separate feedrate limits are required for pumpable and nonpumpable wastes because pumpable wastes are often more easily volatilized and thus can more rapidly deplete available oxygen leading to inefficient combustion and incomplete destruction of organic hazardous air pollutants. Separate feedrate limits are required for each combustion chamber (incinerators) or each feed location (cement kilns and lightweight aggregate kilns) because the oxygen depletion due to overfeeding hazardous waste can be a localized phenomenon.

Limit compliance period -- An (not-to-exceed) hourly rolling average limit is established on the maximum hazardous waste feedrates listed above. Rationale for the use of this averaging period is discussed in Section 2 of this document.

Limit basis -- The limit is set based on conditions demonstrated during the DRE test. The hourly rolling average limit is set as the average over all runs of the maximum one-hour rolling average for each run. For compliance, the hourly rolling average hazardous waste feedrate may not go below its limit.

Measurement techniques – Solid and sludge feedrates can be measured with a variety of techniques including stationary weighing systems (batch scales), conveyor weighing systems (continuous method), volumetric methods (such as auger rotational speeds), level indicators, momentum flowmeters, and nuclear absorption methods. Liquid feedrates can be measured using techniques such as rotameters, orifice meters, flow tube meters, turbine meters, vortex shedding meters, positive displacement meters, and mass flowmeters.

<u>Operation of waste firing system</u>. To ensure that the waste firing system operates properly, limits must be set on the operation of the waste firing system. Because waste firing systems can vary significantly, sources must recommend on a site-specific basis in the comprehensive performance test work plan (submitted for review and approval) operating parameters, limits, and monitoring approaches to ensure that each hazardous waste firing system continues to operate as efficiently as demonstrated during the comprehensive performance test.

For example, HWCs that utilize liquid injection will likely need to establish limits on the minimum firing nozzle pressure and the maximum liquid waste viscosity. For pressure atomizers, the pressure of concern is the pressure of the liquid waste. For twin-fluid atomizers, the pressure of concern is that of the assist fluid (typically steam or air). Pressure measurements are typically made with a pressure transducer. Viscosity can be measured by a viscometer. At least two such devices, based on rotary-measurement and piston-driven principles, are commercially available. Note that viscosity is a function of temperature. The facility would need to document in its comprehensive performance test work plan how it will measure and continuously comply with the viscosity limit. One example might be to develop a correlation between temperature and viscosity for a particular waste type and to use the temperature of the waste at the nozzle as a surrogate for viscosity.

10.0 Combustion System Leaks

Combustion system fugitive leaks can result from leaks from the combustion chamber(s), air pollution control equipment, or any ducting that connects them. Fugitive emissions must be controlled by one of the following:

- The combustion zone must be kept totally sealed;
- The combustion chamber pressure must be kept lower than atmospheric pressure; or
- An alternate means of control (reviewed and approved by the Agency as part of the comprehensive performance test work plan) must provide fugitive emissions control that is equivalent to maintenance of combustion zone pressure lower than ambient pressure.

In the cases where a combustion zone pressure limit is maintained, compliance is required on an "instantaneous" basis – measurements must be made continuously without interruption and with no integration (no averaging period). Pressure monitoring detector type, and monitoring and recording frequency must be sufficient to detect combustion system leaks; and must be selected on a site-specific basis, and included in the Agency reviewed and approved comprehensive performance test work plan. Note that differential pressure transducers (typically used to measure combustion chamber pressure) are capable of providing a continuous electronic signal with response times down to 10 milliseconds.

Also, note that:

- The combustion zone does not include portions of the system downstream of an ID fan, where above-ambient pressures are expected and allowable.
- It is possible to have below-ambient pressures in an unsealed part of the combustion system (e.g., a rotary kiln) and above-ambient pressure in a sealed part of the combustion system (e.g., a vertical secondary combustion chamber with an associated emergency vent stack). This is possible, for example, due to the "Thermal Siphon" effect caused by the buoyancy of hot gases. It is only necessary to maintain and record below-ambient pressure in those sections of the combustion system which are not totally sealed. For example, if an incinerator system includes an unsealed rotary kiln and a secondary combustion chamber that is sealed such that the only possible gas pathways out of the secondary are downstream through the air pollution control system or upstream through the rotary kiln, then the secondary can be considered "totally sealed" and it is only necessary to monitor combustion chamber pressure (and maintain it at below-ambient pressure) in the rotary kiln.

- Cement kilns often have above-ambient pressure surges in the kiln hood due to a momentary oversupply of air from the clinker cooler, but no fugitive emissions result because only cooler air is present in this above-ambient region. Thus, it may not be possible to measure the pressure in the true combustion zone; instead, the maximum combustion zone pressure limit might be replaced by a minimum ID fan power limit or a limit on the minimum differential pressure across the kiln. It is the sort of situation that the "alternative monitoring requirements" (approved by the Agency) option allowed for under §63.1209(g) is designed to address.

- State-of the art kiln seal design exists that can withstand positive pressure surges. The US Department of Energy (USDOE) facility at Savannah River, SC, that has been used for handling radioactive waste. The Savannah River kiln uses multiple graphite seals with pressurized chambers between seals to prevent out-leakage at kiln pressures up to 10 psig. Another USDOE facility at Oak Ridge, TN uses overlapping spring plate seals to form an air seal, and is designed to handle pressures up to 2 psig. [See "Support Document for Fugitive Emission Control, February 2002, S0004 of Docket Number F-220-RC6F-FFFFF, NESHAP: Standards for Hazardous Air Pollutants for Hazardous Waste Combustors (Final Amendments Rule), February 14, 2002]

Additionally, part of the operation and maintenance plan should include periodic inspections (and corrective actions as necessary) to ensure that system fugitive control is being maintained. This should include: daily visual inspection of seals, joints, doors, and other openings. The use of fugitive detectors, such as Drager tubes, or CO_2 or CO portable monitors, is also highly recommended.

11.0 Automatic Waste Feed Cutoff Requirements

11.1 Parameters Linked to AWFCOs

Automatic waste feed cutoffs (AWFCOs) are required when certain parameters exceed their operating limits. An AWFCO must be interlocked with the parameter of concern, and it must immediately stop the flow of hazardous waste feed to the combustor. AWFCO parameters include:

- CEMS-monitored emission standards
- Operating parameter limits for PM, SVM, LVM, Cl, and PCDD/PCDF
- Combustion leak parameters (such as maximum combustion chamber pressure
- Failure of the automatic waste feed cut-off system.
- Whenever continuous monitoring systems (CMS) or the measurement component of the CMS registers a value beyond its rated scale, or the CMS has a malfunction.

For parameters which are a combination of continuously monitored and periodically monitored elements (e.g., metals feedrates which are calculated from the continuously monitored waste feedrate and the periodically analyzed metals concentration), the AWFCO must be interlocked with the continuously monitored parameter, or with a reduced parameter which is updated continuously as the continuously monitored parameter changes. For example, a liquid injection incinerator may have a liquid hazardous waste feedrate limit and may utilize a waste acceptance criteria that limits the allowable mercury concentration in the liquid hazardous waste. In this situation, the facility could tie the mercury feedrate limit AWFCO directly to the continuously-monitored liquid hazardous waste feedrate based on the conservative assumption that the mercury concentration in the liquid hazardous waste is at the waste acceptance criteria limit. Alternatively, if the facility has a data acquisition system which can (based on the product of the periodically input liquid hazardous waste mercury concentration and the continuously input liquid hazardous waste feedrate) calculate the liquid hazardous waste mercury feedrate each time the liquid hazardous waste feedrate is updated, the AWFCO can be tied to the liquid hazardous waste mercury feedrate.

Some sources may have unique design characteristics which make it impossible or impractical to continuously monitor all of these AWFCO parameters. In such situations, the operator is advised to request the use of alternative monitoring techniques as allowed under §63.1209(g).

11.2 Ramping Down Waste Feed

In situations where there are physical constraints that prevent sources from cutting off waste fuel (or make it impractical or unsafe to do so) at the same instant in time that an exceedance of an AWFCO parameter is detected, the operator is advised to set alarm levels such that the waste feed can be cut off and/or other appropriate actions can be taken before an exceedance will occur.

In some cases, an immediate and complete shutdown of hazardous waste feed could cause a perturbation resulting in an increase in HAP emissions. This is most likely to be true when the waste is the primary fuel source and is being continuously fed (as is typically true for pumpable organic hazardous wastes).

In the event of an AWFCO, the waste feed of pumpable hazardous waste may be ramped down to zero over a period of up to one minute. Note that ramping down is not allowed for nonpumpable hazardous wastes, their feeds must be immediately cut to zero in the event of an AWFCO. In addition, ramping down is not allowed for pumpable waste feeds if the automatic waste feed cutoff is triggered by an exceedance of: minimum combustion chamber temperature, maximum hazardous waste feedrate, or any hazardous waste firing system operating limits that may be established. This is because these operating conditions are fundamental to proper combustion of hazardous waste and an exceedance could quickly result in an exceedance of an emission standard.

Facilities electing to ramp down the waste feed must document ramp down procedures in their operating and maintenance plan. The procedures must specify that the ramp down begins immediately upon initiation of automatic waste feed cutoff and the procedures must prescribe a gradual, bona fide ramping down. For example, it would not be acceptable to continue feeding waste at the same rate for one minute beyond the initiation of an AWFCO, then suddenly shut it down to zero.

If an emission standard or operating limit is exceeded during the ramp down, the facility will have failed to comply with the emission standards or operating requirements of the rule.

11.3 AWFCO Testing

The AWFCO system must be tested at least weekly to verify operability Test procedures and results must be documented and recorded in the operating record. If the owner/operator documents in the operating record that weekly inspections will unduly restrict or upset operations and that less frequent inspection will be adequate, AWFCO operability testing can be extended, but it must be conducted at least monthly.

11.4 AWFCO Investigations and Reporting

If an exceedance of a standard or operating limit occurs (irrespective of whether hazardous waste is in the combustion system), in conjunction with or as a result of an AWFCO, the source must investigate the cause of the AWFCO, take appropriate corrective measures to minimize future AWFCOs, and record the findings and corrective measures in the operating record.

If 10 exceedances of emission standards or operating limits occur while hazardous waste remains in the combustion chamber, based on site-specific hazardous waste residence time determinations, in any 60 day period, the owner/operator must investigate the cause and submit a written report within 5 calendar days of the 10th exceedance documenting the exceedances and results of the investigation and corrective measures taken. After the 10th exceedance in any 60 day period triggers the exceedance report requirement, the 60 day period and the counting of exceedances begin anew.

On a case-by-case basis, the Agency may require excessive exceedance reporting when fewer than 10 exceedances occur during a 60-day block period.

A source may choose to shut off its waste feed (automatically or otherwise) before an exceedance of an AWFCO parameter occurs. In such a situation, if no subsequent exceedance occurs while hazardous waste remains in the combustion chamber, then there is no exceedance, and the event is not included in the 10 in 60 day exceedance count.

11.5 Other AWFCO Considerations

After an AWFCO, combustion gases must continue to be ducted to the air pollution control system while hazardous waste remains in the combustion chamber. The AWFCO parameters must continue to be monitored during the cutoff, and the hazardous waste feed cannot not be restarted until the AWFCO parameters are back within the specified limits.

When hazardous waste no longer resides in the combustion chamber (after an AWFCO or any other cessation of hazardous waste burning), a source may elect to comply with either the HWC MACT standards or with other applicable MACT standards for non hazardous waste combustors (e.g., for cement kilns, the portland cement kiln MACT). If there are no MACT standards for the source category , the source would not be subject to any MACT standards (so long as hazardous waste no longer resides in the combustion chamber), unless and until such standards are promulgated and their compliance date arrives. Note that all sources must determine the amount of time that hazardous waste resides in the combustion chamber following a waste feed cutoff. Sources which elect to comply with alternative standards when they temporarily cease burning hazardous waste must comply with all of the notification requirements of the alternative regulation; comply with all the monitoring, record keeping and testing requirements of the alternative MACT; modify their Notice Of Compliance to include the alternative mode of operation; and make a note in the operating record that identifies the beginning and the end of each period when they are complying with the alternative MACT.

12.0 Continuous Monitoring Systems (CMS)

CMS Installation, Calibration, Operation, and Maintenance

CMSs must be installed, calibrated, operated, and maintained consistent with manufacturers specifications. CMS operating and maintenance procedures must be documented in the CMS Quality Control Program discussed below. Procedures to replace or repair malfunctioning CMS must be included in the startup, shutdown, and malfunction plan.

Note that there are two specific CMS calibration / accuracy requirements:

- Thermocouples and pyrometers – Thermocouple calibration must be verified at least once a year (or more frequent if required by manufacturer specifications). Optical pyrometer calibration procedures must be consistent with manufacturers specifications; calibration frequency must also be per manufacturer specifications, and at least once a year, unless otherwise approved by the Agency.

- Weight measurement devices for sorbent – Sorbent weight measurement device accuracy must be within ∀1% of the weight being measured; the device must be calibrated at least once every 3 months.

CMS Performance Evaluation

A CMS performance evaluation must be conducted during each comprehensive performance test. The CMS performance evaluation testing requires determination of CMS accuracy and precision, involving side-by-side comparison of facility CMS and reference method audit CMS response. A CMS performance evaluation test plan must be included as part of the comprehensive performance test work plan. The test plan should include a description of activities used to assess CMS performance, and data quality objectives (accuracy, precision, and completeness of data).

CMS Quality Control Program

A CMS quality control program must be developed and implemented (§63.8(d)). The program must be kept in the operating record. The program must describe procedures including:

- Calibration of CMS.
- Determination and adjustment of CMS calibration drift.
- Preventative maintenance.
- Data recording, calculations, and reporting.
- Accuracy audit procedures.
- Corrective action program for malfunctioning devices.

CMS and Excess Emissions Performance Report

Sources must submit to the Agency a CMS Performance and Excess Emissions Report on a semi-annual basis. They must be submitted quarterly when excessive emissions or operating parameter limit exceedances are experienced. The sources must have a full year operation without excessive emissions or exceedances before it can go back to semi-annual reporting. A request may be made for a longer reporting time if a good compliance history is developed. If the exceedance times are less than 1% of the operating time, and downtime is less than 5%, then only a summary report needs to be submitted. The excessive emissions and CMS performance report must contain (§63.10(c)(5)-(13)):

- Date and time identifying each period during which the CMS was inoperative, except during calibration checks.
- Date and time identifying each period where the CMS is "out of control" (is not meeting its quality assurance and quality control performance evaluation chekcs on zero or upscale drift, as appropriate).
- Date and time identifying each period of excess emissions and parameter monitoring exceedances.
- Nature and cause of CMS malfunctions and corrective actions/
- Plan to eliminate excessive emissions in the future.
- The summary report must contain (§63.10(e)(3):
- Emissions and CMS data summary, including total duration of exceedances and downtimes.
- Description of any changes in CMS, processes, or controls since the last reporting period.

CMS Data Handling

CMS data recording must be made on a continuous, uninterrupted basis. The response must be evaluated at least once every 15 seconds; average values must be computed and recorded at least every 60 seconds. Note that this does not apply to parameters which may require "instantaneous" monitoring, such as combustion system pressure.

13.0 Continuous Emissions Monitoring

13.1 General CEMS Requirements

The HWC MACT rule requires the use of CEMS for compliance with the carbon monoxide (CO) or hydrocarbon (HC) standards. As discussed in Section 10, these surrogate standards are used for the control of non-PCDD/PCDF HAP organic products of incomplete combustion (PICs), and for assurance of compliance with DRE and PCDD/PCDF HWC standards. There are considerable public and regulatory concerns about the potential risks of organic HAP PICs from HWC units. Carbon monoxide is considered an indicator of good combustion practices. Sudden increases in CO are generally indicative of poor mixing of fuel/waste and air, or some other form of combustion upset. High CO conditions may also indicate the likelihood of the formation of PICs. HC are considered direct indicators of the relative level of PICs in the effluent gas stream.

CEMS emission limits for both CO and HC are standardized to 7% O_2, therefore, oxygen monitors are also required.

Opacity monitoring is required for cement kilns only.

No other CEMS are required for compliance:

- HCl and Cl_2 – HCl CEMS are readily demonstrated and commercially available. However, they are not required for the HWC MACT rule because: (1) Cl_2 CEMS are not readily demonstrated or available, thus compliance with the total chlorine MACT limit cannot be made solely with the HCl CEMS; (2) system operating parameter limits are very effective at assuring continued compliance; and (3) HCl/Cl_2 have relatively low toxicity.

- PM – Various types of PM CEMS are commercially available[12]. Recent (and on-going) demonstration studies for PM CEMS are very encouraging. However, various PM CEMS issues still remain:

  -- Demonstration that PS-11 can be achieved when PM CEMS are used at the diverse types of hazardous waste combustors..

  -- Relation of the PM CEMS requirement to the PM emission standard.

[12] See Section 4.3 and Appendix C of this document for more information on PM detectors, most of which can be used as a PM CEMS.

-- Implementation of the PM CEMS requirement (i.e., relation to all other testing, monitoring, notification, and recordkeeping).

- Mercury – Various Hg CEMS are commercially available. Like PM CEMS, recent demonstration studies for Hg CEMS are very encouraging, particularly for use on coal fired boilers and incinerators. However, technical issues similar to PM CEMS remain.

- SVM and LVM – A few SVM/LVM CEMS are in the development and demonstration phase.

Sources may petition the Agency to use CEMS for these HAPs for compliance monitoring in lieu of compliance with the corresponding operating parameter limits discussed in other Sections of this document. The mechanism and procedures for filing the petition are defined under §63.8(f), "Alternative Monitoring Methods". For example, if a source were approved to use a continuous mercury emissions monitor to demonstrate compliance with the mercury standard, then none of the related operating parameter limits would need to be set nor would there be a requirement for manual stack testing (beyond the monitor calibration testing). For more discussion of the alternative monitoring request, see Section 23.11.

13.2 Performance Specifications and Data Quality Assurance Requirements

Performance specifications (PS) and data quality assurance (DQA) requirements for CO, HC, and O_2 CEMS are required, as discussed below, to ensure accurate and unbiased measurement.

PS and DQA requirements for optional HAP CEMS that are requested for use (but not required by the MACT rule) must be developed on a site-specific basis, and contained in the reviewed and approved comprehensive performance test work plan. The PS and DQA procedures should be consistent with the capabilities of the CEMS, and requirements to assure compliance with the HAP standards. Draft performance specifications contained in various EPA proposals may also be considered for determining PS and DQAs for optional CEMS.

13.2.1 Performance Specifications

Performance specifications (PS) for CO, HC, and O_2 monitors are shown in Table 13-1, including requirements for instrument span and scale resolution, calibration and zero drift, relative accuracy, calibration error, and response time. The PSs are all found in 40 CFR Part 60, Appendix B, including PS 4B for CO and O_2, and PS 8A for HC.

Compliance with the PSs is required during the initial compliance with the HWC MACT rule (during the initial comprehensive performance test). Subsequent frequency of these QA/QC checks that are required to demonstrate compliance with the PSs are discussed in the next "Data Quality Assurance" section.

Table 13-1. CEMS Performance Specifications

Requirement	CO	O_2	HC	Opacity
Performance Specification	PS-4B	PS-4B	PS-8A	PS-1
Span	0-200, 0-3000 ppmv (0-10,000 ppm optional upper range)	0-25% O_2	0-100 ppmv (0-500 optional upper range)	
Scale Resolution	0.5% span	0.5% span	0.5% span	0.5% opacity
Upscale Span and Zero Drift	3% span	0.5% O_2	3% span	2% opacity
Calibration Ranges	Zero, span	Zero, span	0-0.1, 50-90% of span	Zero, span

Absolute Calibration Audit (ACA)				
Calibration Error (CE)	5% span	0.5% O_2	5% span	3% opacity
Calibration Ranges	0-20, 30-40, and 70-80% of each different span range	0-2, 8-10, and 14-16% O_2	0-0.1, 30-40, and 70-80% of span	
Relative Accuracy Test Audit (RATA)				
Relative Accuracy (RA)	10% RM or 5% emission limit (5 ppmv)	20% RM or 1% O_2	Not applicable (7 day calibration test)	Not applicable
Response Time	2 min. to 95% stable	2 min. to 95% stable	2 min. to 95% stable	10 sec.

Four types of testing are used for demonstrating compliance with the PSs (specific testing protocols are discussed in the PSs):

- Calibration Drift (CD) test – Used to demonstrate the stability of the CEMS calibration over time. The analyzer portion of the CEMS is challenged with "zero" gas and cylinder gas (NIST traceable) at the upper span value. Testing is conducted once per day over a 7 day period. No adjustments, repairs, or unscheduled maintenance to the CEMS can be performed during the 7 day test. Test gases are injected as close as possible to the sample probe outlet. CDs are determined as the difference between the CEMS response and the know challenge cylinder gas reference level.

- Calibration Error (CE) test – The entire CEMS is challenged with zero and cylinder gases over the span range, typically with cylinder gases at three different levels. The challenge gas must be introduced as close to the sampling nozzle as possible. Initially, this test is conducted during the CD test.

- Response time test – Conducted during the CD test to assess the response time of the CEMS.

- Relative Accuracy (RA) test – Simultaneous CEMS and reference method (RM) monitor measurements are compared during 9 tests of 30 to 60 minutes in duration while the source is in typical operation. Both the CEMS and reference method measurements are made in the stack, at or near the same location.

Note the following for determining PS spans:

-- Span values correspond to conditions with an oxygen correction factor of one (at 7% O_2).

-- If the oxygen correction factor at the CEMS sampling location during normal operations is more than two (operation with O_2 levels greater than 14% by volume), the span must be proportionally lower than those in the PS.

-- A single range CO span may be used, but it must meet the PSs for the low range (0-200 ppmv).

-- The O_2 span may be higher than 25% for facilities where O_2 may exceed 25%.

-- Alternative span values may be requested.

13.2.2 Data Quality Assurance – CEMS QA/QC Program

The quality assurance requirements for gaseous CEMS (CO, O_2, and HC) are contained in the Appendix to Subpart EEE, Part 63 -- Quality Assurance Procedures for Continuous Monitors Used for Hazardous Waste Combustors (these requirements supercede Procedure 1 – QA requirements for gaseous CEMS – in 40 CFR Part 60 Appendix F).

The procedure specifies the minimum QA/QC requirements necessary for the control and assessment of the quality of the CEMS data. It requires that a CEMS QA/QC program be developed and included in the operating record. The program must contain written procedures describing the QA/QC activities.

The QC segment of the program must discuss:

- Checks for components failures, leaks, and other abnormal conditions.
- Calibration of CEMS.
- CD determination and adjustment of CEMS.
- Integration of CEMS with the AWFCO system.
- Preventative maintenance of CEMS.
- Data recording, calculations, and reporting.
- Checks of recordkeeping activities.
- Accuracy audit procedures, including sampling and analysis methods.
- Program or corrective action for malfunctioning CEMS.
- Operator training and certification procedures.
- Maintaining and ensuring current certification or naming of cylinder gases and sampling used for audit and accuracy tests, daily checks, and calibrations.

The QA portion of the program must include:

- QA responsibilities (including maintaining records, preparing reports, and reviewing reports).
- Schedules for the daily checks, periodic audits and preventative maintenance.
- Check lists and data sheets.
- Preventative maintenance procedures.
- Description of the media, format, and location of all records and reports.
- Provisions for a review of the CEMS data at least once a year. Based on results of the review, the QA plan may be revised as necessary.

The QA/QC program must include various tests and inspections:

- Daily system audit and inspections – Daily inspections of calibration check data, recording system, control panel warning lights, and sample transport and interface system (flowmeters, filters, etc.).

- Daily zero and upscale span calibration drift checks – Zero and upscale span drift checks must be performed daily, similar to the CD tests of the PS. The CEMS calibration must be adjusted if the drift checks do not meet the PS. If the individual drifts exceed two times the PS, or the cumulative drift exceeds three times the PS, hazardous waste burning must be stopped, and the CEMS must be recalibrated by carrying out a new ACA.

- Absolute Calibration Audit (ACA) -- The ACA – which is referred to in Procedure 1 of 40 CFR Part 60 Appendix F as the "Cylinder Gas Audit" (CGA) -- is the same as the PS calibration error test. It must be conducted quarterly, except for the quarterwthen the RATA is performed.

- Relative Accuracy Test Audit (RATA) -- RATA's involve an assessment of a CEMS relative accuracy through comparison to simultaneous reference method measurements. They must be conducted annually (and with the comprehensive performance test on the year that they coincide). They are required for CO and O_2 monitors using the PS RA test. For HC CEMS, the seven-day calibration drift check test is used in lieu of RA test.

Alternative QA and QC procedures are likely required for optional CEMS, such as "Response Calibration Audits" to check the stability of the calibration relation between the CEMS response and the reference method.

13.3 CEMS Data Handling

Beyond-Span Spikes

Special data handling procedures are required when emission "spikes" cause CO or HC CEMS response to go off-scale (higher than the upper scale span of the monitor):

CO CEMS

When the CO CEMS records a 1 minute average above the 3000 ppmv minimum span level under 4B, the 1 minute average must be assumed to be 10,000 ppmv when calculating the hourly rolling average level.

Alternatively, a CO CEMS with a higher span range of 10,000 ppmv may be used. CO CEMSs that elect to use a third span of 10,000 ppmv are subject to the same CEMS PSs for PS 4B when operating in the range of 3,000 to 10,000 ppmv.

HC CEMS

When the HC CEMS records a 1 minute average above the 100 ppmv minimum span level required by PS 8A, the 1 minute average must be assumed to be 500 ppmv when calculating the hourly rolling average level.

Alternatively, a HC CEMS may use a second span range of 0-500 ppmv. HC CEMS that use a second span value of 500 ppmv are subject to similar CEMS PSs for 8A when operating in the range of 100 to 500 ppmv.

Moisture Correction

For HC CEMS, a moisture correction must be made (as well as for other CEMS that make measurements on a "wet" basis). It is preferred that a moisture CEMS be used. For systems with wet scrubbers that have moisture saturated stack gases, it may be most accurate to determine moisture content based on the stack temperature. Alternatively, for sources where the moisture level is not expected to fluctuate widely, the moisture level may be based on that measured in a representative performance test.

Oxygen Correction

For certain operations (such as startup or shutdown) where oxygen levels may be very high, oxygen levels representative of normal, routine (non startup or shutdown) operations may be used in place of actual oxygen levels. Procedures should be discussed in the Startup, Shutdown, and Malfunction Plan.

Determination of Rolling Averages

CO and HC CEMS require data sampling at least every 15 seconds, with a determination of an average over each 1 minute period. 1 hour rolling averages are determined and updated every one minute, based on the previous 60 different 1 minute averages.

Periods of time when 1 minute values are not available for calculating the hourly rolling average are ignored, such as during instrument calibration. When 1 minute values become available again, the first new 1 minute value is added to the previous 59 values to calculate the hourly rolling average.

CO and HC CEMS must continue to operate during hazardous waste feed cutoffs.

14.0 MACT Performance Testing

Two types of performance testing are required to demonstrate compliance with the MACT standards and set operating parameter limits: comprehensive performance testing and confirmatory performance testing.

14.1 Comprehensive Performance Testing

Comprehensive performance testing is used to:

- Conduct manual stack gas sampling to demonstrate compliance with MACT emissions standards that are not monitored with a CEMS – including PM, total chlorine, metals, PCDD/PCDF, and DRE, if optional CEMS are not used.

- Establish operating parameter limits (OPLs) to ensure compliance is maintained during subsequent on-going operations for standards for which a CEMS is not used.

- Demonstrate compliance with the CEMS monitored MACT emissions standards of CO and HC (and opacity for cement kilns).

- Demonstrate compliance with other emissions standards using optional CEMS.

- Demonstrate that the CEMS and CMS meet appropriate quality assurance requirements.

14.1.1 Schedule

Initial Testing

The initial comprehensive performance testing must begin within 6 months after the compliance date (the compliance date is 3 years from the final rule promulgation date). (We note, however, that Phase I sources—incinerators, cement kilns, and lightweight aggregate kilns—are required to commence the initial performance test under the final rule within 12 months of the compliance date.) Testing must be completed within 60 days after commencement (a request may be made to the Agency for an extension). Test results must be submitted within 90 days of completing the comprehensive performance testing and CMS and CEMS evaluations, and are included as part of the Notification of Compliance (NOC). The NOC must be submitted within 270 days after the compliance date. The NOC includes documentation of compliance with the MACT standards and identification of operating parameter limits.

Subsequent Testing

Comprehensive performance testing must be repeated at least every 5 years after the initial performance test. A window of 5 years ∀ 30 days is allowed for conducting subsequent performance tests. Testing may be required more frequently due to either: (1) any significant changes in facility operation which will adversely impact compliance with the MACT standards; or (2) failure of confirmatory performance tests.

Subsequent performance testing can be conducted at any time prior to the required date. If a subsequent comprehensive performance test is performed sooner than a multiple of 5 years (less 30 days) from the initial comprehensive performance test, the anniversary date (and the associated 60 day window) for each comprehensive performance test thereafter is advanced accordingly.

For example, consider 3 facilities which all begin their initial comprehensive performance tests exactly 180 days after the effective rule compliance date:

- Facility A begins its second comprehensive performance test 5 years + 30 days after beginning its initial comprehensive performance test. The third comprehensive performance test must begin by 10 years + 30 days after beginning its initial comprehensive performance test.

- Facility B begins its second comprehensive performance test 5 years - 30 days after the initial testing. This facility's third test must begin by 10 years + 30 days after beginning its initial comprehensive performance test).

- Facility C begins its second comprehensive performance test early, i.e., more than 30 days sooner than 5 years from the initial testing. This facility's third comprehensive performance test must begin by 5 years + 30 days after beginning its second comprehensive performance test; and its fourth comprehensive performance test must begin by 10 years + 30 days after beginning its second comprehensive performance test.

Results for subsequent comprehensive performance tests must be submitted to the Agency, along with a revised NOC documenting compliance with the emission standards, CEMS and CMS requirements, and revised operating parameter limits. As with the initial NOC, the revised NOC must be postmarked within 90 days following the completion of performance testing and the CEMS and CMS performance evaluation.

Test Plan and Testing Notification and Approval

Comprehensive performance test work plans must be submitted 1 year prior to the planned test date (the date the test is scheduled to begin). The Agency has 9 months to review the plan and provide comments to the source. Test plan approval is not automatic after the 9 month period. That is to say, test plan approval should not be assumed if the source has not heard from the Agency plan reviewers within 9 months. Further, lack of an approved test plan does not excuse the source from conducting the comprehensive performance test within the required timeframe. Thus, it is critical that the source monitor the review progress and work closely with the permitting official to ensure that the test plan is approved prior to the required test date.

A notification of performance testing must be submitted to the Agency 60 days prior to testing. The Agency may, but is not required to, review and oversee the testing.

After the test work plan has been approved by the Agency, the sources must make the test work plan available to the public for review; and a public notice must be made by the source announcing the approval of the test plans, and the location where the test plan is available for review.

Extensions

Initial -- An extension of up to 1 year may be requested in certain circumstances.

Subsequent -- A time extension of up to one year time may also be requested for any performance test conducted subsequent to the initial comprehensive performance test. This may be done to facilitate consolidation of the MACT performance testing and any other RCRA risk burn emission testing required for issuance or reissuance of Federal/State permits, and allows for delaying tests due to unforseen circumstances. If a delay is granted such that a subsequent comprehensive performance test is performed later than a multiple of 5 years (plus 30 days) from the initial comprehensive performance test, the anniversary date (and the associated 2 month window) for each comprehensive performance test thereafter is delayed accordingly.

A request for the extension is made to the Agency. The request must include reasons why the extension is needed, and dates for testing. The Agency will respond to the request within 30 days of receipt of sufficient information to evaluate the request. If intending to deny the request, the Agency will provide the applicant with the information on which the denial is based. The applicant has 15 days to provide the Agency with additional arguments supporting the extension request.

14.1.2 Test Plan Content

The comprehensive performance test work plan outlines in specific detail all of the planned testing activities. Various components of the comprehensive performance test plan include:

Facility Description

- Detailed engineering description of facility and combustor system, including design and operating characteristics, equipment manufacturer name and model numbers, capacities, etc.:

  -- Combustor unit, including burner and combustor design and operating characteristics.
  -- Waste handling and feeding system and operations, including waste source, preparation, storage, blending and feed systems.
  -- Air pollution control system, including device type and design and operating characteristics.
  -- Exhaust system, including ducts, fans, and stacks.
  -- Monitoring and control systems.
  -- Waste feed cutoff systems.

- Brief description of the facility site and surrounding land use, and summary of the history of the combustor (owners, modifications, operations, etc.).

Feedstream Analysis

- Description of wastes and other feedstreams that are fed to unit:

  -- Source of wastes.
  -- Composition, with ranges. Constituents including heating value, metals, ash, chlorine, physical properties such as viscosity and density, organic hazardous constituents established by 42 U.S.C. 7412(b)(1), RCRA Appendix VIII hazardous constituents, etc.
  -- Waste pre-preparation activities, such as blending.

Operating Plan

- Description of purpose of different testing conditions.

- For each different test condition, detailed test protocol, including:

  -- System process operating parameter levels, with target limits and rationale for the limits (including expected quantity of each waste type, POHC, and metal).
  -- Process monitoring data to be recorded, including parameter, location and type of monitor, operating range, units, and recording method.
  -- Number and duration of test runs.
  -- Target testing schedule, including test dates, testing length, analytical schedule, etc.
  -- Characteristics and composition of waste and process feed streams.
  -- Rationale for POHC, metals, and/or chlorine spiking types and rates.

- Documentation of system conditioning procedures to ensure steady-state operations during each operating condition.

- Hazardous waste residence time in combustor system for each test condition.

Sampling and Analysis Plan

- Sampling, monitoring, and analytical procedures for feedstreams, stack gas emissions (including CEMS), and operating parameters (including CMS). This includes: description of sampling and monitoring points, analysis parameters, sampling frequency, sampling and analysis methods, specification of detection limits, and rationale for use of alternative sampling and analysis methods.

- Testing protocol, including:

  -- Schedule, showing detailed time line of pre-test, test, and post-test activities.
  -- Personnel and responsibilities, identifying key personnel with responsibilities and qualifications. These should include the responsible facility manager, compliance test manager, field sampling manager, and QA coordinator. It should also identify field testing, analytical laboratory, and consultant firm personnel and qualifications.
  -- Facility shutdown procedures.

- Data recording systems and procedures.

- Data reduction procedures, equations, and test report outline.

Quality Assurance Project Plan

- Quality assurance and quality control plan for testing, containing specific procedures used for ensuring the quality of the sampling and analysis activities.

Other Operating Plans

- CMS quality assurance plan.

- Operator training and certification program, and facility operating manual, is recommended but not required.

- Emergency safety vent operation plan is recommended, but not required.

- Start-up, shutdown, and malfunction plan is recommended, but not required.

- Operation and maintenance plan is recommended, but not required.

- Feedstream analysis plan is recommended, but not required.

Miscellaneous Special Requests

- Rationale for requests for:
  -- Operating parameter limits that are to be based on manufacturer/designer specifications or engineering judgement.
  -- Alternative monitoring procedures.
  -- Data compression allowances.
  -- Metals/chlorine feedrate limit extrapolation.
  -- Special cement kiln requirements as appropriate, including in-line raw mill operating time, by-pass stack gas representativeness, etc.
  -- Alternative standards request for industrial kilns.
  -- Alternative PM standards for incinerators.

14.1.3 Operating Conditions or Modes

The comprehensive performance test consists of one or more operating conditions or "modes" of operation. The number of modes is based on the desired operating flexibility, where multiple modes may allow for operation under various different conditions and with combinations of different wastes:

- A single operating condition is appropriate when burning well defined wastes and operating under constant conditions.

- Multiple operating conditions should be evaluated when it is desired to operate under different conditions when burning many different types and sets of wastes.

- In some cases, a single "universal" operating condition can be defined to provide sufficient operating flexibility to allow for burning of a broad range of wastes. The test condition must be designed for the worst case conceivable conditions expected to be encountered during every-day operations.

For cement kilns, multiple operating conditions are needed when the kiln operates an in-line raw mill.

14.1.4 Number and Duration of Runs in Operating Condition

Each test condition must consist of a minimum of three valid individual test "runs". Each must be conducted under similar operating conditions. Compliance with the non-CEMS MACT emissions standards is based on the average of individual test runs.

The duration of each test run will depend on the requirements of the specific stack gas sampling method that is used, as discussed below for each stack gas method. Typically, the stack gas methods are conducted over a 2 to 4 hour period.

14.1.5 Operating Parameter Limits

Comprehensive performance testing is used to set operating parameter limits (OPLs). The OPLs are used as surrogates to ensure compliance with the MACT standards that are not monitored on a continuous basis with CEMS during subsequent "on-going" operations. The required OPLs have been previously discussed in detail for each of the different HAP or HAP surrogates.

14.1.6 Waiver of Operating Limits During Subsequent Testing

Most existing operating limits, and associated ties to automatic waste feed cutoffs, are waived during subsequent comprehensive performance testing, with or without an approved test plan. That is to say, new operating limits may be set during each new comprehensive performance test. There is no restriction on operating limits during the performance testing. This is to avoid "racheting down" of operating limits as new comprehensive performance tests are performed. Existing operating limits may also be waived during "pretesting" evaluations prior the comprehensive performance testing, as requested in the work test plan (Agency approved or unapproved). The pretesting must not exceed 720 hours of operation, and is intended to cover time for testing for HAP and HAP surrogates and operations to reach steady state conditions. Sources are not allowed, either in pretesting or in a new comprehensive performance test, to operate under conditions which will result in emissions which exceed the standards. If a source desires to extend its operating limits in a subsequent comprehensive performance test, it must provide justification in the test plan that the emissions standards will be met under the desired operating limits.

This waiver of operating limits, and tie to AWFCO system, is not applicable to CEMS based emissions standards (CO or HC at a minimum) or combustion system leak operating limits (such as limit of chamber pressure or other appropriate procedures).

14.1.7 Alternative Parameter Monitoring Requests

The comprehensive performance test plan should include any request for alternative monitoring parameters that are appropriate on a site-specific basis.

Additionally, it is the responsibility of the permitting official to include limits on any additional operating parameters that are appropriate on a site specific basis. For example, this might include limits on: (1) batch related parameters; (2) various parameters related to special air pollution control devices; etc. Potential additional parameters that might be important to consider on a case-by-case basis are discussed in the previous section.

14.1.8 Conflicting Parameters

It is anticipated that in most situations it will be possible to operate in a single mode under which "worst-case" levels for all operating parameters are simultaneously achieved. For example:

- Operation at minimum combustion temperature and maximum waste feedrate and flue gas flowrate through adjustment of auxiliary fuel and excess air levels.

- Operation under minimum combustion temperature and maximum dry APCD temperature through controlling of flue gas temperature operations (e.g., water quenching rate, air infiltration rate, waste heat boiler load, etc.)

Nonetheless, there may be unique instances where due to the interdependence of certain parameters, it may not be possible to simultaneously achieve "worst-case" levels for all operating parameters (for example, for some venturi scrubber designs, minimum venturi pressure drop and maximum flue gas flowrate). In these cases, it may be necessary to test two or more sets of conditions under the same operating mode. Operating parameters should be kept as similar as possible in the conditions. The test plan should identify the conflicting parameters, reasons for conflict, and changes in operating parameters that will be made to allow for testing at worst case for the conflicting parameters.

Operating limits for the conflicting parameters (and for other parameters which are tied to them and cannot be independently controlled) will be set from the test condition designed to be worst case for those parameters. Operating limits for other parameters will be based on the most stringent levels of the multiple conditions (in practice this should not make much difference because the operating parameter should be kept as similar as possible).

14.1.9 Steady State Operations

Prior to testing, the facility must be operating in a "steady state" equilibrium mode under the desired operating condition to ensure representative testing. Rationale and procedures for ensuring system equilibrium prior to testing must be contained in the comprehensive performance test plan.

For conventional incinerators, this should involve pre-test operations of at least the residence time of the waste in the system, and in practice should be a minimum of 60 minutes before sampling.

For CK, LWAKs, and other units, the establishment of equilibrium may take a longer period due to recirculation of collected dust and internal recycle conditions or large system thermal inertia. In these cases, procedures and guidance outlined in the EPA's "Technical Implementation Document for EPA's BIF Regulations" (U.S. EPA, 1992) should be used. This may include the monitoring of collected system residues or information from previous testing from the facility or similar facilities.

14.1.10 Waste Selection

Comprehensive performance testing is conducted with wastes containing levels of HAP, and ash feed rates, which approximate the high end of normal hazardous waste feedrate variability. Rationale for the selection of these wastes and composition levels must be included in the test plan. Waste selection and composition is based on an evaluation of the characteristics and composition of wastes to be burned (from historical waste composition data and/or from expected future wastes), as determined through the feedstream analysis plan.

The use of actual wastes is preferred in the testing. However, to achieve desired operating flexibility, it may be opted to use "surrogate" formulated wastes. Rationale for development and use of "surrogate" wastes must be included.

14.1.11 Spiking

"Spiking" of metals, chlorine, and POHCs into the waste may be used to simulate desired operating conditions approximating the high end of normal operating variability. Rationale for the spiking selection must be contained in the comprehensive performance test work plan.

The following guidelines should be considered when developing a spiking procedure:

- Spiked materials should be selected in a form which matches as closely as possible the form of the actual constituents in the wastes (e.g., pumpable vs non-pumpable).
- Solid wastes should be spiked with solid compounds with particles at least as fine as the waste particles.
- Aqueous wastes should be spiked with water soluble compounds.
- Organic wastes should be spiked with organic soluble compounds.
- The spiked feedrate should be measured before mixing the spike with the waste.
- The spiked material should be delivered to the combustor in the same manner as the actual waste is fed.

For metals spiking, the use of pelletized metal, metal powders, or metal salts is recommended for the spiking of solid wastes. Aqueous wastes can generally be simulated with dissolved metal nitrate (or sulfide or chloride) compounds. Due to safety and cost concerns, for organic liquids, soluble organometallics are not generally recommended. Dispersions of metal powder in oil have been successfully used to spike metals in pumpable liquid organic streams. They are especially convenient because of the large range of metals compositions that can be incorporated, and the ease of feeding and handling. Metals dispersions may also be useful when aqueous waste metal solubility limits impact spiking ability. To spike liquid streams that are atomized into the combustor, dissolved metal salt solutions are commonly used.

14.1.12 Sootblowing

The MACT standards were developed from data from individual test runs that did not include sootblowing. Thus, sources need not artificially induce sootblowing during the MACT comprehensive performance testing. Rather, the source should maintain the normal sootblowing cycle.

14.1.13 DRE Testing

The DRE test demonstration only has to be conducted (and the resulting operating limits only have to be set) one time for sources that: (1) do not feed hazardous waste at a location in the combustion system other than the normal flame zone; and (2) do not modify their operations such that DRE is affected. Operating limits can be taken from a previous successful RCRA DRE test, so long as the appropriate measurements were taken, the standards were met, and the test data have sufficient data quality. Operating limits based on historical DRE testing may conflict with limits based on MACT testing. In these cases, the more restrictive limits must be complied with. Historical DRE testing and operating conditions must be documented in the comprehensive performance test plan.

Alternatively, DRE operating limits must be set:

- During the initial comprehensive performance test if suitable historical DRE testing is not available or representative;
- When a source changes design, operation, and/or maintenance practices in a way that may adversely affect its ability to achieve the DRE standard; and
- At every comprehensive performance test for sources that feed hazardous waste at a location in the combustion system other than the normal flame zone.

For sources that require DRE testing, the comprehensive performance test plan should include the rationale for the selection of the POHCs and the POHC levels that are to be used in the testing to demonstrate sufficient DRE. Additionally, it should discuss how these POHCs will be used to set limits on allowable organics feed during subsequent every-day operations.

POHC selection involves evaluation of the most difficult to destroy organic compounds that are likely to be present in the waste. The first step is to identify all Appendix VIII organics that are present in the waste. Next, the destruction characteristics of these organics are evaluated. This involves consideration of a variety of different characteristics that can impact organics behavior in the combustion system (emissions, destruction rate, PIC formation, etc.). These can include the organics' heat of combustion, compound structure, expected level in waste, and relative toxicity. Most recently, the rationale for POHC selection has relied heavily on the Incinerability Ranking System (sometimes referred to as the University of Dayton Research Institute ranking system). This system ranks various organic compounds based on their relative difficulty to be destroyed (i.e, temperature required to achieve a certain percentage of destruction within a given time) in the absence of oxygen.

Additionally, POHC selection should consider potential interferences from PICs that may form independently of the actual POHC destruction efficiency. That is to say, POHCs should not be selected which are present in stack gases as PICs of the fuel, hazardous waste, or other POHCs. POHCs should also be chosen which are not dangerous to handle, are feedable and meterable, and are measurable by reliable and conventional techniques. A survey of "problem" POHCs -- including those which may be PICs, may be difficult to sample and analyze for reasons such as poor recoveries, may have high background levels, and/or may be laboratory contaminants -- is contained in EPA's "Problem Principal Organic Hazardous Constituents (POHC) Reference Directory" (1991).

POHC feedrate levels should be high enough to permit adequate calculation of at least 99.99% DRE (or 99.9999% for PCB or dioxin listed wastes) based on reasonable POHC stack gas sampling method sensitivity (detection limits). However, POHC feedrate levels must also be indicative of the maximum levels of POHC that the incinerator will typically expect to feed in subsequent operations.

For additional guidance on recommended DRE testing procedures, see previous EPA publications for RCRA incinerator and BIF testing -- "Guidance on Setting Permit Conditions and Reporting Trial Burn Results Volume II" (U.S. EPA, 1989), and the "Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations" (U.S. EPA, 1992).

14.1.14 HC and CO Requirements

If a source elects to use a CO CEMS to demonstrate continuous compliance with the CO standard, a one time test is required to demonstrate compliance with the HC standard. Operating limits identical to those for DRE are set based on this testing. If the DRE test is not concurrently run with the HC testing, the more stringent of the operating limits from the two tests will apply. Alternatively, if a HC CEMS is used, no CO testing is required.

14.1.15 Hazardous Waste Residence Time

An estimate of the "hazardous waste residence time" must be included as part of the comprehensive performance test work plan (and also included in the operating record, Notification of Compliance, and Document of Compliance). The hazardous waste residence time is the time elapsed from cutoff of the flow of hazardous waste into the combustor until solid, liquid, and gas materials from the waste exit the combustion chamber. The residence time is critical to determination of compliance during various operations including combustor waste feed cutoffs, startup, shutdown, malfunction, and temporary cessations in burning hazardous waste.

Estimates should be made and reported of both: (1) the residence time of solid waste in the combustor; and (2) the residence time of the flue gas through the combustion system (all the way to the last APCD).

The residence time of waste in a liquid injection combustor is generally governed by the residence time of the combustion gas through the combustion system. This is because liquid waste combustion byproduct solid remnants do not remain or generally accumulate in the combustion chamber.

Alternately, the residence time of solid waste combustors is usually governed by the waste treatment time through the combustor, which is typically on the order of minutes or tens of minutes, as opposed to the flue gas residence time, which is typically on the order of seconds.

For example, the residence time of solids kilns can be estimated based on factors such as kiln rotation rate, solid waste burning characteristics, waste physical form, etc. Alternatively, the residence time can be measured by conducting a waste feed cutoff (of either actual waste or surrogate waste of similar form) and observing how long it takes for the last observable waste to exit the combustion chamber. "Cold" kiln tests may also be appropriate at estimating solid waste residence time in rotary kilns.

For certain industrial kilns (including cement and lightweight aggregate kilns), certain HAP from the hazardous waste are internally recycled within the kiln; additionally, some cement kilns recycle collected PM back into the kiln. These "recycle" loops do not have to be considered when calculating the hazardous waste residence time.

Certain thermal treatment systems have operations where the waste may potentially have a very long residence time in the combustor, or where it is difficult to determine the waste residence time. For example, vitrification melter units, where certain inorganic waste components are incorporated into the vitrified melt, and where it is not desirable to remove the entire melt (i.e., the melt is removed from the chamber at lengthy, infrequent intervals). In these cases, it may be appropriate for the treatment facility to recommend an alternative "effective waste treatment" residence time. This residence time would correspond to the time which is needed for the waste treatment to occur -- beyond which, all organics in the melt have been destroyed, and metals have come to an equilibrium state such that no more volatilization occurs.

In systems that use wet scrubbers, the scrubber liquor will contain HAP removed from the combustion flue gas. Typically the scrubber liquor is recycled back into the scrubber. A portion of the scrubber liquor is blown-down and replaced with fresh clean liquor to reduce the buildup of captured constituents. However, due to the use of recycled liquor, the scrubber may be considered a potential source of emissions as well as a collector. Thus, although this is not part of the combustion chamber, it may be appropriate to require continuing compliance with operating limits of any PM, mercury, or chlorine control devices located downstream of the scrubber (if any of these control devices exist downstream of the scrubber) for as long as collected HAP are projected to remain in the recirculating scrubber liquor; i.e., until the scrubber liquor has been effectively purged of collected HAP through blowdown.

The hazardous waste residence time is not intended to include consideration of:

- Residues that collect on or adhere to combustion chamber surfaces (walls, refractory, boiler tubes, bottom ash collection, etc.).
- The time it takes to fully remove hazardous waste combustion derived ash collected from dry APCDs (such as FF or ESPs).

14.1.16 One-time PCDD/PCDF Testing for Units Without Numerical PCDD/PCDF Standard

HWCs that are not subject to a numerical PCDD/PCDF emission standard – solid fuel boilers, liquid fuel boilers with either no PM control device or those that use wet scrubbers (those that are without dry PM air pollution control devices), lightweight aggregate kilns that comply with the temperature limit on combustion gas at the kiln exit in lieu of the 0.20 ng TEQ/dscm standard, and HCl production furnaces – are required to conduct a one-time test for PCDD/PCDF levels during the initial comprehensive performance test.

Sources must test under feed and operating conditions that are most likely to reflect maximized expected daily variability of dioxin/furan emissions. Such testing is similar to a comprehensive performance test to demonstrate compliance with a numerical dioxin/furan emission standard where operating limits would be established based on operations during the test. As a practical matter, however, we note that many of the operating parameters discussed below, although controllable to some extent, cannot be quantified and cannot be controlled to replicate the condition in a future test. In addition, some operating parameters we identify may not have as strong a relationship to dioxin/furan emissions as others. Consequently, the operating conditions are generally described subjectively.

You should consider the following factors to ensure that you conduct the test under operating conditions that seek to fully reflect maximum daily variability of dioxin/furan emissions::

- High loading of soot and ash on boiler tubes prior to testing.
- Metals feedrates prior to and during testing at the high end of the range of normal feedrates.
- Chlorine feedrate during testing at the high end of the range of normal feedrates.
- Operation under the stressed combustion conditions used to demonstrate compliance with the DRE standard (high waste feed, low oxygen, low temperature) prior to and during testing.
- For units with wet scrubbers, solids loading in scrubber liquor prior to and during testing at the high end of the loadings that occur during normal operations.
- Normal or lower sulfur levels during testing.
- ESP or FF temperatures for solid fuel boilers at the high end of the range of normal operations (i.e., the temperature limit that would allow the source to operate under the full range of normal operating conditions) during testing.

14.1.17 Consequences of Testing Failure

The burning of hazardous wastes must be stopped immediately under any condition for which there is failure of any performance testing requirement. Burning must stop as soon as the source learns that a failure has occurred; this must be within 90 days following the performance test. If testing is conducted under multiple modes of operation, the source can continue to burn wastes under any mode of operation for which all of the standards have been met during the testing. Also, the source may petition the permitting authority to operate under proposed interim operating conditions during the time between the testing failure and retesting.

An NOC must be submitted documenting the failure. Prior to subsequent demonstration testing, an investigation must be made evaluating reasons for the testing failure, and rationale for subsequent desired operating conditions. Hazardous waste may be burned for up to 720 hours (30 days) for purposes of pretesting or retesting under modified conditions. The 720 hours is renewable after each test failure as often as the Agency deems reasonable.

14.2 Confirmatory Performance Testing

Confirmatory performance tests are used to confirm compliance with the PCDD/PCDF MACT emission standard. These tests are conducted during "normal" representative operations. They are not used to set operating parameter limits since the conditions are not intended to reflect variability which may occur.

14.2.1 Schedule

The confirmatory testing is performed midway between the comprehensive performance testing, i.e., 2.5 years after the comprehensive performance testing. There is a similar two-month testing window allowance, as for comprehensive performance testing.

As with the comprehensive performance test, confirmatory performance test results must be submitted to the Agency as part of the notification of compliance (NOC) documenting compliance with the PCDD/PCDF emission standard. The NOC must be postmarked by the 90th day following the completion of performance testing.

The confirmatory test plan and notification of testing must be submitted at least 60 days before the testing is scheduled to begin. The Agency has 30 days to review the plan. Regulatory officials may, but are not required to, review and observe the testing.

As with the comprehensive performance test, the Agency may grant up to a one year time extension for any confirmatory performance test. This allows a source to avoid testing under undesirable weather conditions (e.g., in the winter in Minnesota). Such an extension does not affect the schedule of any subsequent comprehensive performance tests.

14.2.2 Test Plan Development

The confirmatory performance testing plan has many of the same type of general components as that for comprehensive performance testing. The main difference is that: (1) testing is not used to set operating parameter limits as in the comprehensive performance testing; and (2) testing is only performed for PCDD/PCDF. Confirmatory performance testing is used solely to confirm that PCDD/PCDF emissions levels meet the MACT standard under typical "normal" operating conditions, as opposed to "stressed" conditions required in comprehensive performance testing.

A primary component of the test plan will be rationale and documentation of "normal" PCDD/PCDF related operating parameter levels that will be used in the testing. These include parameters related to good combustion (such as combustion temperature, flue gas flow rate, and waste feedrates), dry PM air pollution control device temperature, and PCDD/PCDF APCD operating parameters (such as those for activated carbon injection, carbon beds, inhibitors, catalytic oxidation, etc.). Specifically, it is required that the average of all PCDD/PCDF related operating parameters be held during the testing between "normal" and "stressed" levels -- i.e., between the average of long term, normal operations and the operating limit (as determined in the comprehensive performance test when the source maximized controllable operating parameters that affect dioxin/furan emissions to reflect the full range of normal operating variability). The average is defined as the average over the previous 12 month period, not including calibration data, malfunction data, startup and shutdown, and data obtained when not burning hazardous waste. For parameters with rolling average limits, this is calculated as the sum of all rolling averages recorded over the previous 12 months, divided by the number of rolling averages recorded in the same period.

Although not anticipated, if, on a site-specific basis, there is concern about the inability to simultaneously achieve normal levels for all required parameters, requests may be made in the confirmatory compliance test plan for operation under alternative conditions. Additionally, the Agency may accept test results based on operations outside of the range specified in the test plan when a source was unable to maintain the required range due to unseen factors. The Agency will consider the following factors when evaluating whether to accept data taken from operating conditions outside of the excepted range:

- The magnitude and duration of the deviation from the required range.
- The historical range of the parameter.
- The proximity of the PCDD/PCDF test result to the HWC MACT standard.
- Reasons for not maintaining the required range for the operating parameter(s).

Also, the plan must include the rationale for selection of typical normal wastes for testing and rationale for normal chlorine feedrate levels.

14.2.3 Consequences of Testing Failure

The burning of hazardous waste must be stopped immediately after learning of a failure of confirmatory performance testing. This finding must be made within 90 days following the completion of the performance test. A report must be submitted evaluating the reasons for the failure, with recommendation on modifications of system design or operation to meet the standard. Retesting can then be done to demonstrate compliance with the PCDD/PCDF emissions standards (and any other standards that may be affected by changes made), and establish new operating parameter limits. The facility can burn hazardous waste up to 720 hours (one month) for purposes of pretesting; this may be extended based on a petition containing justification for further pretesting to the Agency. If compliance has been demonstrated under certain modes of operation during both the comprehensive and confirmatory testing, then operation may continue only under those modes.

14.3 Other Issues

14.3.1 Quality Assurance and Quality Control Plan

The comprehensive and confirmatory performance test work plans must include a Quality Assurance Project Plan (QAPjP) to ensure monitoring, sampling, and analytical data meet specific data quality objectives, and to provide a framework for evaluating data quality. Specific procedures and guidance for preparing the QA plan are found in:

- U.S. EPA, "Guidance on Quality Assurance Project Plans," EPA QA/G-5, U.S. EPA Quality Assurance Management Staff, September 1997.

- U.S. EPA, "U.S. EPA Requirements for Quality Assurance Project Plans (QAPPs) for Environmental Data Operations," Draft Interim Final, EPA QA/R-5, U.S. EPA Quality Assurance Management Staff, August 1994.

- U.S. EPA, "Handbook: Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration," EPA/625/6-89/023, January 1990.

QAPjP plans must include:

- Title page with approvals.
- Table of contents.
- Project description, including program objectives, sampling and analysis program (methods, collection frequency, etc.), and schedule.
- Project organization of personnel, responsibilities, and qualifications, including identification of QA officers, sampling and analysis coordinators, oversite personnel, etc.
- Data quality objectives, expressed in terms of precision, accuracy, and completeness.
- Sampling and monitoring procedures. This must include detailed discussion of sampling location, frequency, methods, containers, volumes, and QA/QC procedures for all different matrices that are sampled.
- Sample custody, including description of procedures used to handle, preserve, and track samples.
- Calibration procedures and frequency for monitoring and sampling and analysis equipment.
- Analytical procedures, including discussion of method standard operating practices, including sampling preparation, cleanup, and analytical methods for each matrix and analytical parameter.
- Internal quality control checks, including a description of quality control checks such as:
  - -- Blanks (method, trip, and field blanks)
  - -- Spikes (field, matrix, and surrogate)
  - -- Replicates
  - -- Laboratory calibration and internal standards
- Data reduction, validation, and reporting procedures.
- Preventative maintenance procedures and schedules.
- Procedures to assess data quality objectives.
- Performance audits, and corrective action procedures when data quality objectives are not met.

14.3.2 Performance Test Report

The comprehensive performance test report must be submitted with the NOC. It must contain all of the required information for documenting the testing activities and results of the testing which are provided in the NOC. Specifically, the test report should include at a minimum:

- Summary -- Summary of test condition(s) results, including results of sampling and analysis to show compliance with the MACT standards, and operating parameters limits.
- Introduction -- Discussion of combustor facility, testing objectives, test conditions, test personnel, test schedule, etc.
- Process Operating Conditions -- Detailed documentation of operating parameter levels for each of the different test conditions, including waste and other feedstream composition and feedrates, combustor operating conditions, and air pollution control system operating conditions. At a minimum, average, minimum, and maximum levels should be reported.
- Sampling and Analysis Procedures -- Discussion of sampling and analysis procedures used, taken from the test plan, and modified as appropriate in actual testing. These should include sampling and analysis methods for wastes, stack gas, process operating parameters, etc.
- Stack Gas Sampling Results -- Detailed documentation of stack gas sampling results.
- Deviations -- Discussion of testing problems and deviations from the test plan.
- Miscellaneous -- DRE calculations, metals extrapolation analysis, raw materials alternative standards evaluation, etc.
- Quality Assurance/Quality Control Evaluation -- Results of quality assurance and quality control assessment procedures.
- Appendices -- Detailed sampling and analysis procedures and worksheets, raw data logs, field logs, analytical data, etc.

14.3.3 Data In-Lieu of Testing

In certain cases, it may be requested to use previous emissions testing data to serve in-lieu of comprehensive performance testing (except for the initial testing) and confirmatory testing. The emissions testing data must: (1) meet all MACT testing requirements -- i.e., contain sufficient information to set all required operating parameters and demonstrate compliance with all MACT emissions standards; (2) meet all MACT QA/QC requirements; (3) be conducted within the last 5 years (this time limit does not apply to data-in-lieu for DRE); and (4) have been collected for meeting RCRA or MACT (or comparable) permit requirements. The request should be made as part of the comprehensive performance test plan. It may be appropriate to use data in-lieu for certain standards, and use performance testing for others.

15.0 Test Methods

15.1 Manual Stack Gas Sampling Methods

Stack gas sampling with manual test methods is required for PM, metals (Hg, SVM, and LVM), chlorine, and PCDD/PCDF. Where applicable, equivalent SW-846 Methods may be used as well.

15.1.1 Metals

EPA Method 29, in 40 CFR Part 60, Appendix A, is required to demonstrate compliance with the MACT standards for mercury, semivolatile metals, and low volatile metals. SW-846 Method 0060 may also be used.

15.1.2 Total Chlorine (Hydrogen Chloride and Chlorine Gas)

15.1.2.1 Compliance with the MACT Standard

To demonstrate compliance with the total chlorine (hydrogen chloride and chlorine gas) MACT standard a source may use.

1. EPA Method 26 or 26A, in 40 CFR Part 60, Appendix A

OR

2. Either methods 320 or 321 as provided in appendix A, of 40 CFR part 63, or ASTM D 6735-01, Standard Test Method for Measurement of Gaseous Chlorides and Fluorides from Mineral Calcining Exhaust Sources--impinger method to measure emissions of hydrogen chloride, and Method 26/26A to measure emissions of chlorine gas, provided that the provisions in paragraphs §63.1208 (b)(5)(C)(*1*) through (*6*) are followed

The MACT chlorine standard was based on data from the SW-846 equivalent to Method 26A (Method 0050). Studies by the American Society of Testing and Materials indicate that the filter used in the Method 0050 train (and the M26/26A trains) may adsorb/absorb hydrogen chloride and cause a negative bias at low emission levels[13]. (See ASTM D6735-01, section 11.1.3 and “note 2” of section 14.2.3). This adsorption leads to a negative bias. However, since this negative bias is inherent in the data used to set the MACT standards, method 26/26A is a valid measure of performance.

It is recommended that the M26/26A filter and sampling train be preconditioned to satisfy this affinity for hydrogen chloride.

---

[13] Cement Kilns and sources equipped with dry scrubbers are particularly impacted.

15.1.1.2 Compliance with Health-Based Emission Limits

Although Method 26/26A may be used to demonstrate compliance with the MACT standard for total chlorine, certain sources cannot use that method to demonstrate compliance with the health-based total chlorine emission rate limits established under §63.1215. See §63.1208(b)(5)(ii). Cement kilns and sources equipped with a dry scrubber must use EPA Method 320/321 or ASTM D 6735-01 to measure hydrogen chloride, and the back-half (caustic impingers) of Method 26/26A to measure chlorine gas. Incinerators, boilers, and lightweight aggregate kilns must use EPA Method 320/321 or ASTM D 6735-01 to measure hydrogen chloride, and Method 26/26A to measure total chlorine, and determine chlorine gas as the higher of the chlorine measurement from Method 26/26A or the value calculated by difference between the total chlorine measurement from Method 26/26A and the hydrogen chloride measurement from Method 320/321 or ASTM D 6735-01 if: (1) the bromine/chlorine ratio in feedstreams is greater than 5 percent; or (2) the sulfur/chlorine ratio in feedstreams is greater than 50 percent. See discussion in the preamble to the final replacement rule for more information.

15.1.3 Particulate Matter

Compliance with the particulate matter MACT standard requires the use of either EPA Method 5, or newly developed EPA Method 5i, in 40 CFR Part 60, Appendix A.

The selection of the method depends on the expected PM emissions level during the performance test. In cases of low levels of particulate matter (i.e., for total train catches of less than 50 mg), it is recommended that Method 5i be used. For higher emissions, Method 5 may be used. Note that this total train catch is not intended to be a data acceptance criterion. Thus, total train catches exceeding 50 mg do not invalidate the method. In practice this will likely mean that all incinerators and most lightweight aggregate kilns will use Method 5i for compliance, while some lightweight aggregate kilns and some cement kilns will use Method 5. Method 5i has been shown to have better precision than Method 5, especially at low PM levels.

15.1.4 PCDD/PCDF

Compliance with the PCDD/PCDF MACT standard requires the use of either EPA SW-846 Method 0023A, in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA SW-846; or Method 23 in 40 CFR Part 60, Appendix A, if requested as part of the Agency reviewed and approved comprehensive performance test work plan.

Request to Use Method 23

As part of the Agency reviewed and approved comprehensive performance test plan, it may be requested to use Method 23 as an alternative to Method 0023A. Method 23 may be appropriate in situations where:

- Past Method 0023A analyses results document that PCDD/PCDF are not detected; or PCDD/PCDF are detected at low levels in the front half of Method 0023A; or PCDD/PCDF are detected at levels well below the HWC MACT emission standard; and

- Design and operation of the combustor has not changed in a manner that might increase PCDD/PCDF emissions.

Alternatively, use of Method 23 is not applicable in situations where:

- Sources have particulate matter containing unburned carbon or activated carbon.

- Past Method 0023A measurements indicate that PCDD/PCDF is contained in the solid particulate front half catch of the sampling train; or PCDD/PCDF is detected at levels that are close to the HWC MACT emission standard.

Method Sampling Time and Volume Requirements

To assure testing consistency from source to source, and that results are representative (have adequate accuracy and sensitivity), it is required to run Method 0023A (or Method 23) for a minimum of three hours for each run, and to collect a flue gas sample volume of at least 2.5 dscm. This requirement is appropriate for all sources, regardless of size or type.

Handling of Nondetects

Nondetected congeners may be assumed to not be present in the emissions when calculating TEQ values for compliance purposes (i.e., nondetects may be treated as zero). (Note that Method 0023A does not make a clear statement on how measurement nondetects should be handled, whereas Method 23 specifically instructs that, for compliance purposes, nondetects should be taken as zero.)

Specification of required minimum detection limits for each congener analysis was considered to assure that sources achieve reasonable detection limits, and prevent abuse and understatement of potential PCDD/PCDF emissions. However, for a variety of reasons, minimum congener detection limits are not specified.

Instead, PCDD/PCDF congener detection limits that are to be achieved are to be included in the Agency-reviewed and approved performance test workplan. Facilities should submit information that describes the target detection limits for all congeners, and calculate a PCDD/PCDF TEQ concentration assuming all congeners are present at the detection limit. If this value is close to the emission standard (for example, within one-half), both the source and the regulatory official should determine if it is appropriate to either sample for longer time periods or investigate whether it is possible to achieve lower detection limits by using different analytical procedures that are approved by the Agency.

This treatment of nondetects and sample time and volume requirements is based on the following considerations.

The basic analytical procedures for EPA Method 23 and EPA SW-846 0023A were first developed in the late 1980's. Target detection limits (TDL) which were originally specified (based on those that a qualified laboratory should be able to achieve) are shown in Table 15-1. Data from this table have been directly incorporated into Method 0023A. Note that for Method 0023A, the mass of any specific congener contained in the sample is the sum of the mass detected in front half plus that found in the back half.

There are many implications to the detection limits achieved by the analytical laboratory. Consider the case where the laboratory reports that none of the PCDD or PCDF congeners were present at sufficient concentration to quantify, and that the analytical detection limits for the measurements were equal to the TDLs listed in Table 15-1. Assuming the source was operating with an average excess air level consistent with 7% O_2 in the stack, and that the sampling contractor collected sample gas for approximately 3 hours at a sampling rate of 0.5 cfm, Table 15-2 shows the upper limit concentration of PCDD/PCDF in the stack at about 0.4 ng TEQ/dscm (based on the assumption that each congener is present at the analytical target detection limit of Method 0023A). This is essentially equal to the standard option of 0.4 ng TEQ/dscm, and about twice that of the option of 0.2 ng TEQ/dscm. If the combustor was operating at higher excess air level (higher oxygen level), the measurement detection limit would probably exceed the 0.4 ng TEQ/dscm option. This outcome is clearly inappropriate from a compliance perspective. The measurement detection limit must be well below the actual emission standard. Thus, it is not appropriate to treat nondetect data at the full detection limit. Note that as discussed below, this is not to imply that the method sensitivity for showing compliance with the standard is inadequate. In fact, actual detection limits that are achieved in current practice are much below the original TDLs.

Table 15-1. PCDD/PCDF Analytical Target Detection Limits (TDLs)

Analyte	Target Detection Limit (pg/sample train)
TCDD/TCDF	50
PeCDD/PeCDF	250
HxCDD/HxCDF	250
HpCDD/HpCDF	250
OCDD/OCDF	500

There are two primary approaches for reducing detection limits. The first is to increase the quantity of analyte collected during the sampling process. This implies increasing the sample extraction time and/or the sample extraction rate. The second avenue for improving the measurement detection limit is for the laboratory to achieve results superior to that indicated by the TDLs listed in Table 15-1.

It is certainly possible for the sampling team to increase the time for sample extraction beyond the typical 3-hour period -- something routinely done in many test programs. The sample extraction rate can be increased above the 0.5 cfm rate assumed in the calculations of Table 15-2. Note however, that proper operation of the sampling train requires that the sampling rate be maintained within certain bounds and that sample rates much in excess of 0.75 cfm are not recommended. There are other practical limits which should also be considered. The filter module is continually collecting solid material. The longer the sampling duration, the more solid material collected and the greater the pressure drop across the filter. For a dirty stack, long sampling periods could be a problem. However, for a facility meeting the MACT PM standards, extended sampling times should not be a major concern.

Table 15-2. Detection Limit Calculation for EPA SW-846 Method 0023A Expressed as I-TEQ

PCDD/PCDF in Stack	I-TEF Factor	SW-846 Method 0023 Target		
		Front Half (ng)	Back Half (ng)	Total (I-TEQ ng)
2,3,7,8 TCDD	1.0	0.05	0.05	0.1
1,2,3,7,8 PeCDD	0.5	0.25	0.25	0.25
1,2,3,4,7,8 HxCDD	0.1	0.25	0.25	0.05
1,2,3,6,7,8 HxCDD	0.1	0.25	0.25	0.05
1,2,3,7,8,9 HxCDD	0.1	0.25	0.25	0.05
1,2,3,4,6,7,8 HpCDD	0.01	0.25	0.25	0.005
OCDD	0.001	0.5	0.5	0.001
2,3,7,8 TCDF	0.1	0.05	0.05	0.01
1,2,3,7,8 PeCDF	0.05	0.25	0.25	0.025
2,3,4,7,8 PeCDF	0.5	0.25	0.25	0.25
1,2,3,4,7,8 HxCDF	0.1	0.25	0.25	0.05
1,2,3,6,7,8 HxCDF	0.1	0.25	0.25	0.05
2,3,4,6,7,8 HxCDF	0.1	0.25	0.25	0.05
1,2,3,7,8,9 HxCDF	0.1	0.25	0.25	0.05
1,2,3,4,6,7,8 HpCDF	0.01	0.25	0.25	0.005
1,2,3,4,7,8,9 HpCDF	0.01	0.25	0.25	0.005
OCDF	0.001	0.5	0.5	0.001
Total Sum (ng)			5.1	1.002

Gas sample rate (cfm)				0.5
Sampling time (hours)				3.0
Gas Volume (m^3)				2.55
Oxygen (%)				7
PCDD/PCDF (ng/dscm I-TEQ @ 7% O_2)				0.39

The most likely avenue for significant reduction in measurement detection limit is through improved laboratory operation. Recall that the TDLs listed in Table 15-1 were developed more than a decade ago and even then contained a safety factor relative to typical operations. In the subsequent years there has been marked improvement in both laboratory equipment and laboratory technique. Informal telephone interviews were held with three major analytical laboratories to assess the dioxin and furan detection limits being routinely achieved. The laboratories contacted included Triangle Laboratories (RTP, NC), Paradigm Laboratories (Wilmington, NC), and Phillips Analytical (Canada). Each of these companies routinely track the detection limits being achieved and perform statistical assessments of their performance. It is fair to say that there is significant variation between the laboratories contacted but all of the labs are routinely achieving analytical detection limits significantly lower than those listed in Table 15-1. A reasonable upper limit for "typical" operation is to take the mean plus two standard deviations. Using that approach all three laboratories are achieving analytical detection limits that are at least a factor of 2 lower than indicated in Table 15-1 and typically the lab performance is a factor of 5 or 6 below the listed TDLs.

Based on the above analysis it is concluded that EPA SW-846 Method 0023A is capable of routinely achieving measurement detection limits well below the MACT standard for all source types. The TDLs listed in the EPA SW-846 Method 0023A should also be taken as marginal analytical laboratory performance. Typical lab operation achieves analytical detection limits that are at least a factor of 2 lower. That lab performance combined with three hours of sampling at 0.5 cfm should produce a measurement detection limit of no more than 0.2 ng TEQ/dscm. That is a factor of two below the upper PCDD/PCDF standard option. If the facility intends to comply with the 0.2 ng TEQ/dscm standard option, either improved analytical detection limits or increased sampling time is recommended.

Potential Formation in Sampling Train

Concern has been expressed about potential bias in the EPA SW-846 Method 0023 sampling train due to catalytic PCDD/PCDF formation in the sampling train probe, line, and filter, due to favorable conditions (temperature and entrained PM).

First, the method does not preclude use of a water cooled or air cooled probe and nozzle; however it is not standard practice to use such cooling. Second, there is nothing in the method that requires gas temperatures to be measured. The hot box environment surrounding the PM filter is required to be controlled to 250EF. However, the temperature of the gas carrying glassware or the filter itself may be well above the hot box temperature for hot stack gases.

As a practical matter though, with respect to PCDD/PCDF formation when the suspended particles travel the length of the probe, there is likely not much difference between the PCDD/PCDF concentration at the stack exit and the concentration of the sample exiting the filter. For typical sampling train operation near isokinetic conditions, the velocity of the gas in the probe will be about one-quarter the stack velocity. A typical probe length is as close to the stack diameter as possible. Thus, a reasonable estimate is that the residence time of the gas in the sampling probe under potentially hot conditions is approximately the same as the time it takes the flue gas to travel four stack diameters. Four stack diameters is on the same order as the location of typical stack sampling platforms from the top of the stack.

Formation in the PM filter is still a potential concern. However, significant catalytic PCDD/PCDF formation is not expected to occur in the sampling train filter (in comparison to that which would occur in the upstream APCD and combustor system) because:

- The actual filter temperature must be lower than that of the stack gas or any of the APCD equipment. The actual temperature will depend on the sample probe length and heat transfer characteristics and hot box operating conditions (temperature, design, etc.)

- The particulate loading in the stack gas pulled through the sampling train is very low, and certainly much lower than that in the flue gas prior to any PM APCD, thus reducing potential catalytic formation. In a similar manner, the amount of PM hold up in the filter over the sampling period is very small in comparison to PM hold up in the primary system APCD, again reducing potential PCDD/PCDF catalytic formation.

- Flue gas residence time across the sampling train filter is much smaller than the residence time in a typical FF or ESP. Thus, the opportunity for catalytic formation through gas phase constituents and PM is reduced in the sampling train.

Note that almost immediately after the gases exit the hot box they are rapidly cooled in a condenser prior to the XAD trap.

Other Notes

Note additionally:

- The main difference between Method 0023A and Method 23 is that with Method 23, the "front" and "back" halves are extracted and combined prior to analysis. There are clear advantages to combining the fractions for a single analysis, however this procedure suffers from the fact that poor recovery of materials collected in the filter is often not discovered. Method 0023A gets around that issue by adding internal standards to both the front and back halves, separately extracting the halves, and separately analyzing the halves.

- PCDD/PCDF results may not be "blank" corrected, as per method guidance.

- EPA has developed analytical standards for certain mono- through tri-chloro PCDD and PCDF congeners. It is encouraged to test for these congeners in addition to the congeners that comprise the TEQ determination. The source is requested that results for these additional congeners be included in the Notification of Compliance. It is planned to use this data to determine if any of these compounds can act as surrogate(s) for the PCDD/PCDF congeners which comprise the total and TEQ. This is attractive because they may be more amenable to measurement with a CEMS. A complete list of these congeners will be included in the implementation document for this rule and updated periodically through guidance.

15.1.5 Principal Organic Hazardous Constituents

For POHCs that are considered as volatile in the stack gas, SW-846 Method 0030 (VOST) is used. It is recommended that at least 3 different sets of VOST pairs per sampling run be used (with 3 runs per condition), with each pair lasting from 20 to 40 minutes to collect 20 liters of sample gas volume, depending on the use of "slow" or "fast" VOST sampling. VOST field blanks are required, and VOST trip blanks and laboratory blanks are highly recommended. Tedlar bag SW-846 Method 0040 may also be used when quantifying highly volatile POHCs.

For semi-volatile POHCs, SW-846 Modified Method 0010 (semi-VOST) is used.

15.1.6 Combined Methods

Any applicable and comparable SW-846 test methods may also be requested to demonstrate compliance. For example, SW-846 Method 0050 for particulate matter and total chlorine (hydrogen chlorine and chlorine gas) may be used in place of EPA Method 5 and Method 26A.

15.2 Solid/Liquid Sampling Methods

There are various characterization requirements for combustor feedstreams, in particular determination of ash, chlorine, and metals content. Characterization of other streams such as bottom ash, fly ash, and other APCD effluent streams may also required; and can additionally be very useful for evaluating test results and system performance.

15.2.1 Sampling

Process stream sampling procedures, frequency, size, and location must also be specified in the comprehensive performance testing plan (similar to that of the feedstream analysis plan). Sampling must be conducted with care to ensure that representative samples are obtained. The site-specific characteristics of the waste stream(s), in particular heterogeneity, knowledge of waste from process generation history, and level of trace constituents, will determine the selected sampling requirements (i.e., procedure, size, and frequency). Sample compositing from various samples taken over the entire test run and sample homogenizing is recommended to increase accuracy while minimizing the analytical requirements.

Solid and liquid sampling methods from EPA and ASTM are recommended, and contained in EPA's SW-846.

15.2.2 Analysis

EPA SW-846 test methods are recommended for use for characterization of liquid and solid feed streams for ash, chlorine, and metals. As part of a move toward performance based measurement methods, other methods may be requested in an Agency-reviewed and approved comprehensive performance test plan and feedstream analysis plan. These methods must be shown to be unbiased, precise, and representative. This should involve quality assurance and quality control method checks including recovery of spiked (or surrogate) analytes, and reproducible results. Target detection limits must be included in the comprehensive performance test work plan.

16.0 Startup, Shutdown, and Malfunction Plan

16.1 Plan Contents

A startup, shutdown, and malfunction plan (SSM) must be developed which describes the procedures for operating and maintaining the source during periods of startup, shudown, and malfunction. The SSM plan must discuss procedures to identify malfunctioning system components, and corrective actions for minimizing the severity and frequency of the malfunction events. The plan must also identify all routine or otherwise predictable malfunctions. Malfunctions are events that are sudden, infrequent, and (critically) not reasonably preventable. Failures that are caused by poor maintenance or careless or improper operation are not malfunctions. The SSM plan should be coordinated closely, or contained within, the operating and maintenance plan. The SSM plan must be contained in the operating record.

The SSM plan must cover all units of the system, including air pollution control devices, waste feed systems, combustor operations, and monitoring equipment. The SSM plan must also include requirements to comply with the automatic hazardous waste feed cutoff system during startup, shutdown, and malfunction events – as part of good operating practices during SSM events. The SSM plan should contain the following elements:

- Startup – Step-by-step, checklist of unit startup procedures. For example, burner ignition, unit warmup with auxiliary fuel, target operating conditions for waste burning, air pollution control device bypass and startup, hazardous waste feeding sequences, etc.

- Shutdown – Step-by-step checklist of unit shutdown procedures. For example, waste and auxiliary fuel feed cutoff procedures and sequences, air pollution control device shutdown procedures, unit cool down procedures, etc.

- Malfunctions – Identification of potential system malfunctions. Discussion of corrective actions and response procedures for each malfunction.

To address RCRA concerns that you minimize emissions during malfunctions and startup and shutdown events, sources may select to comply with either RCRA or HWC MACT Clean Air Act requirements:

- RCRA Option – Comply with either current RCRA, or revised RCRA, permit conditions during SSM events when hazardous waste is in the combustion chamber.

- HWC MACT CAA Option – The SSM plan must be expanded to discuss proactive procedures that are used to identify malfunctions, and minimize the frequency and severity of malfunctions. The SSM must also discuss waste feed restrictions and operating limits during startup, shutdown, and malfunctions. Under this option, the SSM plan must be reviewed and approved by the Agency.

16.2 Reporting

SSM operations must be documented in the operating record to be consistent with the SSM plan requirements. This should include records of the occurrence and duration of each SSM event. SSM reporting requirements include:

- A semi-annual report documenting that all SSM procedures meet the plan requirements.
- For SSM events that are not consistent with the plan requirements, the Agency must be notified by phone or facsimile within 2 working days of the occurrence. A report must be submitted within 7 working days detailing the circumstances of the event, including reasons why the plan was not followed, and any excess emissions that are projected to have occurred.

In the case of an unanticipated event, the plan must be revised within 45 days to include provisions for the event. Additionally, the SSM plan must be revised and updated when any system design, operation, or maintenance changes are made that may adversely affect compliance with any emission standard. Changes to the plan that may increase HAP emissions must be submitted to the Agency in writing within 5 days of making the change.

16.3 Revisions to Plan

The SSM plan must be reevaluated and revised as necessary when 10 exceedances of a HWC MACT operating requirement occur (when hazardous waste remains in the combustion chamber) within a 60 day block period. The investigation must be completed with 45 days of the 10^{th} exceedance. Results must be recorded in the operating record and a summary of the findings must be including in the excess emissions report.

17.0 Emergency Safety Vents

Certain designs of hazardous waste combustor systems include emergency safety vents (ESVs), also referred to as dump stacks, vent stacks, emergency bypass stacks, thermal relief valves, and pressure relief valves. ESVs are used to vent combustion gases directly from the combustion chamber(s) to the atmosphere in the event of a catastrophic failure of the other system components. This may be done for operator safety as well as to protect the incinerator and other downstream equipment from damage. ESVs are typically required for rotary kiln and hearth incinerators which process a portion of their waste load as bulk solids or contained liquids introduced continuously or in batch charges.

ESV use is indicative of serious operational problems. Requirements designed to reduce and mitigate the impact of ESV events include:

- Development of an ESV operating plan.
- Investigating and reporting each event where the ESV is opened.

17.1 Emergency Safety Vent Operating Plan

Sources which utilize an ESV must develop and follow an ESV operating plan. The plan must be kept in the operating record. The plan must outline the procedures that will be taken to minimize the occurrences of ESV openings. The plan must also identify the procedures to be followed during and after an ESV opening. Specifically, it should discuss procedures for rapidly stopping the waste feed, shutting down the combustor, and maintaining temperature and negative pressure during the waste residence time as practicable. It must contain an evaluation of the effectiveness of the plan's procedures for ensuring that the combustion chamber temperature is maintained, and combustor system leaks are prevented. It must also discuss procedures used to calculate HAP emissions as a result of ESV openings. The ESV operating plan may be incorporated into the startup, shutdown, and malfunction plan, provided that a combined plan addresses the events preceding and following an ESV opening.

17.2 ESV Opening Reporting Requirements

An investigation must be made after each ESV opening (which is not a "malfunction" as defined in the SSM plan). Specifically, it must be determined whether the ESV opening resulted in a violation of an emissions standard. The results of this initial investigation must be documented in the operating record. For openings which cause a violation of an emission standard, a further report must be prepared including details on the cause of the ESV opening and appropriate corrective actions taken to minimize future ESV openings. Investigation findings must be recorded in the operating record. A written report of the investigation findings must be submitted to the appropriate regulatory official within 5 days of the ESV opening violation.

Requirements for ESV openings that are a result of "malfunctions" under the SSM plan are discussed in the SSM section of this document.

18.0 Operator Training and Certification Program

Hazardous waste combustors must be operated and maintained by personnel documented to be trained and certified to perform duties that may affect emissions of hazardous air pollutants. Such persons include, but are not limited to: chief facility operators, control room operators, continuous monitoring system operators, sampling and analysis personnel, persons that manage and charge feedstreams to the combustor, persons that operate emission control devices, ash and waste handlers, and maintenance personnel.

The operator training and certification program that is used must be contained in the operating record. All personnel must be familiar with portions relevant to the appropriate job responsibility.

The level of certification and training will depend on the responsibilities of the various operating personnel. Chief facility, shift supervisor, and control room operators must have full certification and training from a program comparable to that developed by ASME. A certified control room operator must be present at the site at all times the source is in operation.

Alternatively, other personnel, including waste and ash handlers, maintenance workers, etc. must receive on-site training from certified facility personnel.

The control room operator training and certification program must conform to either:

- State or EPA approved training and certification program.

- The American Society of Mechanical Engineers (ASME) Standard for the Qualification and Certification of Hazardous Waste Incinerators (ASME Standard Number QHO-1-1994). The program is a two phase process. The first phase is to obtain a Provisional Certification, which involves a general written examination, currently given twice per year by ASME. The second phase, operator certification, involves a site-specific oral examination given by 3 examiners (which may include ASME, hazardous waste industry, facility, or regulatory agency representatives) at the operator site.

- If this program is chosen, provisional certification must be achieved by the rule compliance date; and full certification within one year of the compliance date.

- Site-specific source developed program. The program should be modeled after the ASME program, and must include:

  -- Training on the following subjects:
    .. Environmental concerns.
    .. Basic combustion principles.
    .. Combustor operation, including startup, waste firing, and shutdown procedures.

.. Combustion controls, and continuous monitoring sytems.
.. Air pollution control device operation.
.. Inspection and maintenance of system components.
.. Actions to correct and prevent system malfunctions.
.. Residue characterization and handling.
.. Applicable health and safety regulations.

-- An examination given by the instructor.
-- Written course material.

An annual review course must be completed, which needs to include:

-- Regulation updates
-- Discussion of conditions that cause malfunctions, and responses to malfunctions.
-- Operating problems that have been encountered.
-- Inspection and maintenance procedures.
-- Combustion system operational procedures.

19.0 Operating and Maintenance Plan

Hazardous waste combustors are required to develop, and include as part of the operating record, a combustion system "operating and maintenance" (O&M) plan. The plan must cover all aspects of O&M for the various system components, including the combustor, air pollution control system, waste handling and feed systems, etc.

The O&M plan will contain site-specific operating and inspection requirements beyond the specifically required operating parameter limits (OPLs) discussed previously in this document. Adherence to an O&M plan will help ensure proper operation and performance of the system and continued compliance with the emissions standards of the HWC MACT rule. Coordination between facility operators and permit writers is critical for the development of the O&M plan.

Specific contents of the O&M plan will be determined on a site-by-site basis by the facilities' unique features and characteristics. The O&M plan should include at a minimum all requirements specified by the equipment manufacturer and/or vendor. The O&M plan will likely overlap to some degree, and thus must also be coordinated with both the startup, shutdown, and malfunction plan, and the feedstream analysis plan.

For sources that use a fabric filter, the O&M plan must include a corrective measures plan (to address alarm set-point exceedances) for the bag leak detection system (BLDS) or PM detection system (PMDS). For sources that use an ESP or IWS and that elect to use a PMDS for compliance assurance in lieu of site-specific operating limits, the O&M plan must also include a corrective measures plan.

The following guidance references may be helpful for developing the O&M plan[14]:

- U.S. EPA, "Engineering Handbook for Hazardous Waste Incineration," EPA-SW-889, NTIS# PB81-248163, September 1981. Incinerator system O&M.

- U.S. EPA, "Handbook: Operation and Maintenance of Hospital Medical Waste Incinerators," EPA/625/6-89/024, January 1990. Incinerator and APCD O&M.

- U.S. EPA, "Guidance for Permit Writers, Facilities Storing Hazardous Waste in Containers," NTIS # PB-88-105689, 1992.

- Peray, K.E., "The Rotary Cement Kiln," Chemical Publishing Inc., New York, NY, 1986. Cement kiln O&M.

[14] NTIS Documents are available from NTIS, 5285 Port Royal Road, Springfield, VA, 22161, Phone # (800) 553 6847. EPA Publications can be obtained from EPA, National Service Center for Environmental Publications, Box 42419, Cincinnatti, OJ 45242, Phone # (800) 490 9198

- U.S. EPA, "Wet Scrubber Inspection and Evaluation Manual," EPA 340/1-83-022, NTIS PB 85-149375, September 1983. Wet scrubber O&M.

- U.S. EPA, "Operation and Maintenance Manual for ESPs," EPA/625/1-85/017, NTIS #PB86-216785, September 1985. Electrostatic precipitator O&M.

- U.S. EPA, "Operation and Maintenance Manual for Fabric Filters," EPA/625/1-86/020, NTIS # PB88 – 180120, June 1986. Fabric filter O&M.

- McKenna, J.D. and Turner, J.H., "Fabric Filter - Baghouses I, Theory Design and Selection," ETS, Inc., 1989. Fabric filter O&M.

- Greiner, G.P., "Fabric Filter - Baghouses II, Operation, Maintenance, and Troubleshooting," ETS, Inc., 1989. Fabric filter O&M.

- Heumann, W.L., "Industrial Air Pollution Control Systems," McGraw-Hill, 1997. Fabric filter, wet scrubber, and electrostatic precipitator O&M.

20.0 Feedstream Analysis Plan

A feedstream analysis plan (FAP) is used to ensure compliance during "every-day" operations with feedstream-related operating limits. These include limits on:

- Ash (not required for CK and LWAKs), metals, and chlorine feedrates.
- Certain physical properties of some streams such as viscosity, density, etc.
- Restricting certain waste organic constituents based on DRE POHC allowances.

Characterization for other properties such as heating value, volatility, fluorine, alkalis, etc. is also recommended to further ensure proper system operation.

The FAP documents the sampling and analysis characterization procedures that are used for wastes that are burned, as well as in some cases other non-waste feedstreams, to demonstrate compliance with feedstream-based operating limits. FAPs are highly site-specific, depending on various considerations, including waste type, waste heterogeneity, constituent levels, degree of waste process knowledge, etc.

The FAP is generally very similar to the waste analysis plan (WAP) currently required under RCRA for hazardous waste burning incinerators and BIFs (under 40 CFR 264.341 and 266.102). For existing facilities, existing WAPs will likely be modified as appropriate into FAPs required under the HWC MACT rule. Also, RCRA guidance for development of WAPs is directly relevant for the preparation of FAPs. This includes:

- U.S. EPA, "Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Wastes: A Guidance Manual," U.S. EPA Office of Solid Waste and Emergency Response, OSWER 9938.4-03, PB94-963603, April 1994.
- U.S. EPA, "Waste Analysis Guidance for Facilities That Burn Hazardous Wastes (Draft)," U.S. EPA Enforcement and Compliance Assurance (2224A), EPA 530-R-94-019, October 1994.

The FAP does not replace the WAP. A WAP is still required under RCRA for various purposes, including general hazardous waste acceptance, storage and handling requirements, solid residue analysis requirements, Subpart O facility requirements, etc.

20.1 Plan Review

Feedstream analysis is a compliance procedure for most of the HAP to some degree, and of direct and critical importance for ensuring metals, PM, and chlorine compliance. For existing sources, the FAP must be contained in the operating record. The Agency may request to review and approve the FAP. For new sources, the FAP will be reviewed and approved during the RCRA and CAA permitting process (i.e., prior to commencement of construction). Additionally, the FAP may be reviewed during facility inspections.

The FAP must be amended as appropriate when either: (1) new units are added; (2) processes are changed; (3) new regulations are promulgated; or (4) permit modifications are issued that affect analysis of feedstreams.

20.2 Feedstream Analysis Plan Content

The Feedstream Analysis Plan defines the sampling and analysis protocols and characterization frequency used to determine the feedrate of various constituents at all times of facility operation. The FAP must include:

- Facility description, providing information on waste history and processes that generate waste, expected waste composition, and waste treatment system characteristics.

- Target constituents to be quantified in each feedstream, including at a minimum those needed to meet the required feedstreams limits. Also, rationale for selected constituents.

- All procedures used (and rationale for the selection of procedures) for quantifying the target constituents of the feedstreams. These can include combinations of:

  -- Direct feedstream sampling and analysis. For direct sampling and analysis, EPA SW-846 Methods are suggested. However, any other reliable sampling and analytical methods may be requested as long as they have been shown to be as good as the SW-846 methods (unbiased, precise, and representative).

  -- Process knowledge. Characterizing the stream based on knowledge of the origin of the feedstream, and all materials used in the feedstream generation.

  -- Information obtained from others, such as an off-site waste generator. When information is provided by others, the FAP must document how the combustor will ensure it is complete and accurate. The information must be maintained at the combustion facility whether the combustion facility conducts the analyses or the analyses are obtained from off-site.

  -- Other published or documented data, or information on similar feedstreams.

- Details of the specific sampling and analysis test methods to be used. Quality assurance and quality control activities must be included, including target method detection limits.

Also, the specific sampling and laboratory contractors that are to be used must be identified.

- Procedures used for verifying characterization of wastes received from off-site generators. This will typically include at a minimum, visual inspection, comparison with accompanying waste documentation, and "fingerprinting" analysis (analysis for select constituents).

- Frequency of the analysis to be used, and rationale to ensure that the analysis is accurate and up to date. At a minimum, the analysis must be repeated when the waste combustor operator is notified or has reason to believe that the process or operation generating or producing the feedstream has changed. Also, for facilities which receive off-site generated wastes, reanalysis must be conducted when "fingerprint" analysis does not indicate that the waste matches the provided description.

- Statistical procedures used to evaluate feedstream constituent rates from multiple samples of each different waste stream.

- Procedures used to determine and record the mass or volume flowrate of each feedstream by a continuous monitoring system (CMS). Note that if the waste feedrate is determined on a volume basis (gal waste/min), constituent analysis must be made on a volume basis (lb/gal waste), or else feedstream density must be determined if constituent analysis is made on a mass basis (lb/lb waste) to convert the analysis to a volume basis.

- Procedures to determine and record compliance at all times with feedrate limits, including in particular, procedures to determine total feedrate limits from various individual feedstream measurements when blending is used.

Note that for a few select feedstreams – natural gas, process air, and feedstreams from vapor recovery systems – the chlorine and metals contents which are documented initially in the comprehensive performance test can continue to be used in subsequent on-going operations.

20.3 Quality Assurance and Quality Control

An important part of the FAP is development of quality assurance and quality control procedures and data quality objectives. These should include standard procedures such as analysis of spiked analytes (or surrogate analytes), analysis of duplicate samples, and analysis of blind audit samples.

It is also important that characterization procedures (involving waste handling, sampling, and analysis) outlined in the FAP be performed by sufficiently trained personnel. These personnel must receive training as outlined in the overall facility operator training certification program. Note that this may not necessarily involving full certification for all waste characterization personnel, but would certainly involve some type of on-going on-site training from fully certified personnel.

21.0 Pre-Compliance Data Notifications

Notification requirements during the three year period between the rule promulgation date (effective date of the rule) and the rule compliance date (3 years after the effective rule date for most facilities) include preparation and submission of: (1) the Notification of Intent to Comply; and (2) Documentation of Compliance. Also, a request for extension of the compliance date may be made under certain circumstances.

21.1 Notification of Intent to Comply

Within one year after the rule promulgation date (the effective date of the rule), a Notification of Intent to Comply (NIC) must be submitted. See §§63.1210(b) and 63.1212. The NIC informs EPA and the public of the source's intent to comply (or not to comply) with the HWC MACT standards.

The Notification of Intent to Comply process requires:

- Preparation of an implementation plan ("draft NIC") that identifies each source's intent to comply with the final rule. The plan is released to the public in a public forum. Within 9 months after the rule promulgation date (and at least one month prior to a public meeting), sources must make the draft NIC available to the public and publish advance notice of a public meeting to discuss the draft NIC. Within 10 months after the rule promulgation date, sources must conduct a public meeting to discuss the draft NIC. A summary of this meeting must be included in the final NIC, submitted within one year of the rule promulgation date.

- Formal submission of the implementation plan (final NIC) to the Agency, certifying the source's intentions -- either to comply or not to comply -- and identifying (unenforceable) milestone dates that measure progress towards achieving compliance with the final emission standards or facility closure. Within one year after the rule promulgation, sources must submit this final NIC to the permitting agency.

NIC serves several purposes: as a planning and communication tool in the early implementation stages, to compensate for lost public participation opportunities when using the RCRA streamlined permit modification procedure to make upgrades for MACT compliance, and as a means to share information and provide public participation opportunities that would be lost when new units are not required to comply with certain RCRA permit requirements and performance standards. Please refer to the proposed rule at 69 FR 21313 for additional discussion of the regulatory history, purpose, and implementation of the NIC provisions.

The draft NIC provides general information about the source and discusses how the source intents to comply with the standards. This serves as an initial notice to stakeholders. The public meeting provides opportunity for the general public and other stakeholders to comment and raise concerns. The final NIC informs the agency that the source intends to comply (or not to comply) with the HWC MACT standards. This three step process provides better notice to affected stakeholders and thus smoother overall permitting process.

21.1.1 Content of Draft NIC

The draft NIC for the public meeting must be submitted within 9 months of the date of promulgation of the rule. A summary of information that must be included is presented here (see §63.1210(b) for a complete list)

(i) General information: (Name and address of source operator, whether source is an area or major source, waste minimization and emissions control techniques being considered and effectiveness of such techniques, monitoring techniques being considered, and a general description of how a source intends to comply with the emissions standards)

(ii) Information on key activities – These include dates (or anticipated dates) by which:

- -- engineering designs for emission control systems or process changes for emissions will be developed;
- -- orders for the purchase of component parts to accomplish emission control or process changes will be issued;
- -- construction applications will be submitted;
- -- on-site construction, installation of emission control equipment, or process change will be initiated and completed;
- -- final Compliance will be achieved.

(iii) A summary of the public meeting required under paragraph (c) of this section;

(iv) If source intends to cease burning hazardous waste prior to or on the compliance date ,the NIC must include a schedule of key dates for the steps to be taken to stop hazardous waste activity at your combustion unit.

21.1.2 Public Meeting and Notice

Prior to the submission of the NIC to the permitting agency, and no later than 10 months after the effective date of the emission standards of this subpart, one informal meeting with the public must be held to discuss anticipated activities described in the draft NIC for achieving compliance with the emission standards of this subpart.

Public notice of the NIC meeting must be provided at least 30 days prior to the meeting. The notice must be provided in all of the following forms (see §63.1210(c))

-- Newspaper advertisement.
-- Visible and accessible sign. .
-- Broadcast media announcement.
-- Notice to the facility mailing list.

A summary of the meeting, along with the list of attendees and their addresses, and copies of any written comments or materials submitted at the meeting, must be submitted to the Administrator as part of the final NIC.

The NIC (and progress reports discussed below) must also contain a "Certification of Intent to Comply", which must be signed and dated by an authorized representative of the source:

> "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

The authorized representative should be: a responsible corporate officer (for a corporation), a general partner (for a partnership), the proprietor (of a sole proprietorship), or a principal executive officer or ranking elected official (for a municipality, State, Federal, or other public Agency).

21.1.3 Final NIC

The final NIC must be submitted to the permitting agency within one year of the rule promulgation date (effective rule date). Facilities must modify the draft NIC based on comments received at the public meeting. The final NIC must contain all items required for the draft NIC, as well as:

- A summary of the public meeting.
- A list of public meeting attendees.
- Copies of any written comments or materials submitted at the meeting.

21.2 Documentation of Compliance

The compliance date is three years (four years if a one year extension has been granted) after the effective date. At this time:

- Sources must be in compliance with the emissions standards. This requires placing a Documentation of Compliance (DOC) in the operating record.

- Sources not in compliance with the emissions standards must stop burning hazardous waste.

The DOC must be placed in the operating record on the compliance date. It is not required to be submitted or reviewed by the Agency. The DOC must include operating limits and any other necessary information which ensure compliance with the HWC MACT standards (e.g., automatic waste feed cutoff limits, feedrate limits, and operating limits for emission control devices). Rationale for the DOC limits must be included. The DOC limits must be set based on the results of shakedown tests, manufacturer assertions or specifications, analysis of previous applicable performance tests, or engineering judgment and knowledge of the performance capabilities of the control equipment and system. Also, by the compliance date, sources are required to have all CMS and CEMS installed, calibration, and continuously operating to show compliance with the limits. The DOC must document this.

The DOC limits remain in effect until submission of the Notification of Compliance. All operating limits identified in the DOC are enforceable limits. However, if these limits are determined, after the initial comprehensive performance test, not to have been adequate to ensure compliance with the MACT standards, the source will not be deemed to have been out of compliance with the MACT emissions standards, provided that the operating requirements specified in the DOC were developed with good faith and the source complied with the DOC limits.

21.3 Compliance Date Extension

An extension of the compliance date may be requested in certain circumstances.

Pollution Prevention and Waste Minimization

An extension of up to one year may be requested for installation of measures for pollution prevention or waste minimization which will significantly reduce the amount and/or toxicity of hazardous wastes.

Extensions requests for pollution prevention or waste minimization must contain the following information:

- Description of pollution prevention or waste minimization controls.

- Emissions reduction goals.

- Estimate of pollution prevention or waste minimization procedure impact on hazardous constituents released to the environment through other emissions, wastes, or effluents.

Good Faith Effort

Existing rules (which were not reopened for comment and are not being reconsidered; we are mentioning these existing requirements here in the interests of completeness) allow an extension of up to one year may be requested for installation of measures for pollution prevention or waste minimization which will significantly reduce the amount and/or toxicity of hazardous wastes.

Request Procedure

The requests must be made in writing one year prior to the compliance date. The Agency should notify the facility of the decision within 30 days of receipt of sufficient information to evaluate the request.

22.0 Notification of Compliance

To ensure compliance with the standards by the rule compliance date (3 years from the effective rule date), the operating record must contain a Documentation of Compliance (DOC) as discussed above which identifies limits on the specified operating parameters projected to be necessary and sufficient to comply with the emission standards. These operating parameter limits (and the HC or CO standards, or other standards that are opted to be monitored with continuous monitoring systems) are enforceable until the submission of a Notification of Compliance (NOC). The operating parameter limits identified in the NOC supersede the limits of the DOC (or a previous NOC) upon postmark of the NOC. The NOC limits must be complied with upon submittal of the NOC.

The NOC requirements are generally consistent with those of §63.7. As discussed below, the NOC must contain performance test results documenting compliance with the emission standards and continuous monitoring system requirements, and identify applicable operating parameter limits. Note that the NOC must be postmarked by the 90th day following the completion of performance testing and the CMS performance evaluation. An extra 30 days for result submittal beyond the 60 day deadline are allowed because the PCDD/PCDF analyses may take additional time to complete.

Note that if multiple units are tested at the same facility, separate NOCs must be prepared for each unit.

22.1 NOC Schedule

The NOC must be postmarked within 90 days of completing the comprehensive performance test. Boilers and HCl production furnaces must start the initial comprehensive performance test within 6 months of the compliance date and incinerators, cement kilns, and lightweight aggregate kilns must start the initial comprehensive performance test within 12 months of the compliance date. .[15] The performance test must be completed within 60 days of initiating the test.

A new NOC submission is required for the initial comprehensive test and for each subsequent comprehensive and confirmatory test. Subsequent comprehensive performance tests must be initiated within 60 months (i.e., five years) of the initial comprehensive performance test. Subsequent NOCs, containing test results and operating limits, must be submitted within 90

[15] Phase I sources—incinerators, cement kilns, and lightweight aggregate kilns are not required to start the initial comprehensive performance test until 12 months after the compliance date given that they are already engaged in periodic performance testing to demonstrate compliance with the Interim Standards. See §63.1207(c)(3).

days after the completion of subsequent tests. The current applicable NOC must be retained and made available by the source, upon request, for inspection by the Agency.

22.2 NOC Content

The NOC must contain information to document compliance with the emission standards, continuous monitoring system requirements, and operating parameter limits. Specifically, it must include:

- Results of the comprehensive performance test, continuous monitoring system performance evaluation, and any other monitoring procedures or methods that the source conducted.

- Test methods used to determine the emission concentrations and hazardous waste feed concentrations, as well as a description of any other monitoring procedures or methods that the source conducted.

- Procedures used to identify the appropriate operating limits and feed rate limits.

- Limits for the appropriate operating parameters and hazardous waste feed rates that are necessary to determine continued compliance with the emission standards.

- Other reporting requirements that are applicable to the source, including but not limited to the frequency of future performance or confirmatory tests, excess violations report requirements, continuous monitoring system performance evaluations, automatic waste feed cutoff system checks, continuous emissions monitoring systems relative accuracy test audit requirements and performance checks, operator training requirements, etc.

- A description of the combustion system and air pollution control equipment and the associated hazardous air pollutant that each device is designed to control, as well as a description of the monitoring technique and methods that ensure control of the associated hazardous air pollutant.

- Identification of differences between target planned test conditions and actual test conditions, and reasons for differences.

- A statement from the owner/operator or the company's responsible official that the facility is in compliance with the relevant standards and requirements of this rule.

- Information required under §63.1215 to implement the optional health-based emission limits for total chlorine.

22.3 Sample Notification of Compliance Forms

Example forms that may be considered for NOC reporting are provided in Appendix A.

22.4 Failure to Submit a Timely Notification of Compliance

Hazardous waste burning must be ceased immediately if a required NOC is not postmarked and submitted by the appropriate date. Prior to submitting a revised NOC, sources may burn hazardous waste only for the purpose of pretesting or conducting new comprehensive performance testing and only for a maximum of 720 hours (renewable at the discretion of the Agency).

22.5 Incomplete NOC

The enforcement approach to incomplete submissions is generally determined on a site-specific basis. Developing enforcement responses to all the possible levels of incompleteness for the NOC is beyond the scope of the Agency's national rule making. Furthermore, defining what constitutes an incomplete submission requires specific prescription of a complete submission, which is not possible for all situations or all source designs. Some sources may require more detail than others in defining the parameters necessary to determine compliance on a continuous basis. Instead, the Agency defines the minimum information necessary in the submission while the permitting authority determines if more information is necessary in a facility's site-specific NOC.

The permitting authority will also determine on a site-specific basis the time periods that will be granted to submit additional information because some information requests may require widely varying degrees of time and effort to develop. Many potential problems associated with incomplete submissions can be prevented through interaction between the source and the regulatory agency during the test plan review and approval process.

22.6 Relationship Between the NOC and the Title V Permit

Operating requirements documented in the NOC must be included in the Title V permit -- either through initial issuance if the source does not yet have a Title V permit, or through a permit revision if the source already has a permit. Including information from the initial NOC in Title V permits should not create the potential for any compliance conflicts. Because it is the first time the NOC operating requirements are incorporated into the permit, there would be no requirements already in the permit with which could be in conflict with the NOC requirements.

For subsequent NOCs developed pursuant to periodic performance tests, it is highly recommended that the source coordinates the five year comprehensive performance testing schedule (and NOC preparation and submission) with the 5 year Title V permit term to the extent possible. This would allow changes in the NOC to be incorporated into the permit at renewal rather than through separate permit revisions. This also helps to minimize the number of permit revisions, as well as, the likelihood of having two sets of requirements with which to comply.

23.0 Special Provisions

23.1 Cement Kilns with In-line Raw Mills[16]

Some cement kilns vent the kiln gas through the mill that grinds the raw materials (the raw mill) to recover energy and help dry the raw materials before charging. When the raw mill is out of service, the kiln continues to operate using stockpiled ground raw materials, and bypassing the raw mill. Emissions of some HAP can be different, depending on whether or not the raw mill is on-line. Passing through the raw mill provides an additional opportunity to scrub or adsorb metals and chlorine from the kiln gas leading to lower stack emissions of these species when the raw mill is on. Conversely, depending on the temperature, the composition of the raw materials, and on volatility, the hot kiln gas may volatilize some metals and chlorine species out of the raw materials, leading to higher stack emissions of these species when the raw mill is on. In this situation, time-weighted average emissions may be used to determine compliance with Hg, SVM, LVM, and total chlorine standards. Time weighted averaging is not allowed for compliance with:

- The PCDD/PCDF standard because PCDD/PCDF are primarily dependent upon the APCD temperature, which cement kiln operators are expected to control, regardless of whether the raw mill is on or off.
- The CO/HC standards because HC and CO are monitored continually and serve as a continuous indicator of combustion efficiency.
- The PM standard. PM emissions levels are not dependent on raw mill operational status.

Averaging is done according to the following equation:

$$C_{total} = \{(C_{mill\text{-}off}) \times (T_{mill\text{-}off} / (T_{mill\text{-}off} + T_{mill\text{-}on}))\} + (C_{mill\text{-}on}) \times (T_{mill\text{-}on} / (T_{mill\text{-}off} + T_{mill\text{-}on}))\}$$

where:

C_{total} =	time weighted average concentration of a regulated constituent considering both raw mill on time and off time.
$C_{mill\text{-}off}$ =	average performance test concentration of regulated constituent with the raw mill off-line.
$C_{mill\text{-}on}$ =	average performance test concentration of regulated constituent = with the raw mill on-line.
$T_{mill\text{-}off}$ =	time when kiln gases are not routed through the raw mill
$T_{mill\text{-}on}$ =	time when kiln gases are routed through the raw mill.

16 We note that this is an existing provision of the Interim Standards and was not reopened by the April 20, 2004 proposed rule. We are including this information in this document for completeness.

In the test plan for the comprehensive performance test, facilities must notify the Agency of their intent to use time-weighted averaging. Historical raw mill operation data must be submitted and used in the test plan to justify allowable time weighting factors (the fraction of time that the mill is expected to be on and off), to estimate the future down-time the raw mill will experience, and to document that estimated emissions and estimated raw mill down-time will not result in an exceedance of the emission standard on an annual basis.

A performance test is performed in two modes: one with the raw mill on and one with the raw mill off. The facility must use the above averaging equation to document in its Notification of Compliance that the emission standard will not be exceeded based on the compliance test emissions and predicted raw mill down-time. Enforceable operating parameter limits are set during a comprehensive performance test for each mode, which includes the amount of time the raw mill can be offline such that the estimated emissions will be below the applicable standards on an annual basis.

Compliance during continuing operation is determined based on compliance with the operating parameter limits established for each mode (e.g., 1- hour, and 12-hour rolling average operating limits established in the off-line mode must be complied with whenever the raw mill is off line). In addition, beginning on the day the owner or operator submits the initial notification of compliance, a once-yearly determination must be made that the facility remains in compliance with the emissions standards. This is done by compiling the historical records of the year to determine the amounts of time the kiln gas was routed and not routed through the raw mill and applying these times to the emissions concentrations measured for each mode of the comprehensive performance test using the above averaging equation to determine if the facility was in compliance for the year. Facilities are advised to continually track their raw mill on/off time throughout the year in order to assure that the once-yearly annual determination will, in fact, demonstrate compliance.

23.2 Cement Kilns With Separate By-pass Stacks[17]

Short cement kilns may bypass the preheater and/or precalciner and route a portion of the kiln gas to a separate APCD and separate stack. The bypassing is used to provide an outlet for alkali salts which would otherwise build up because they tend to vaporize in the kiln, condense out in the preheater, and recycle back into the kiln along with the counterflowing raw materials. Some HAP (e.g., semi-volatile metals) behave much like alkali salts. Because of this, these HAP tend to be present in much lower concentrations in the gas entering the main APCD and stack than in the gas entering the bypass APCD and stack. Depending on the relative efficiencies of the main and bypass APCDs, emission concentrations in the bypass stack can be significantly different from those in the main stack. In this situation, gas flowrate-weighted average emissions may be used to determine compliance with Hg, SVM, LVM, and total chlorine standards.

[17] We note that this is an existing provision of the Interim Standards and was not reopened by the April 20, 2004 proposed rule. We are including this information in this document for completeness.

For other HAP or HAP surrogates:

- HC/CO – Emission averaging to demonstrate compliance with the HC/CO standard is not needed at preheater and preheater-precalciner cement kilns with dual stacks since these kilns are only required to monitor HC or CO in the bypass stack. Note that new kilns at greenfield locations must also comply with a main stack HC standard. For these sources, emission averaging for HCs would not be appropriate because the purpose of the main stack HC standard is to control organic hazardous air pollutants that originate from the raw material.

- PM – Stack averaging is not allowed. PM MACT emissions levels at fully achievable at both the main and bypass stacks.

- PCDD/PCDF – Stack averaging is not allowed because cement kilns with dual stacks are expected to control temperature in both air pollution control systems to comply with the standard.

Averaging is done according to the following equation:

$$C_{tot} = \{C_{main} \times (Q_{main} / (Q_{main} + Q_{bypass}))\} + \{C_{bypass} \times (Q_{bypass} / (Q_{main} + Q_{bypass}))\}$$

where:

C_{tot} = gas flowrate-weighted average concentration of the regulated constituent
C_{main} = average performance test concentration demonstrated in the main stack
C_{bypass} = average performance test concentration demonstrated in the bypass stack
Q_{main} = volumetric flowrate of main stack effluent gas
Q_{bypass} = volumetric flowrate of bypass effluent gas

Facilities planning to comply with emissions standards based on gas flowrate-weighted average emissions must notify the Agency of this intent, along with a description of the proposed operating limits, in their performance test workplan.

During a performance test, samples must be taken simultaneously from both the main stack and the bypass stack. Operating parameter limits are set from the comprehensive performance test. Sources must document their use of this emission averaging provision in their Notification of Compliance and document the results of the emissions averaging analysis after estimating the flow weighted average emissions with the above equation.

Kilns with bypass stacks must develop and incorporate into their Notification of Compliance, operating parameter limits that ensure their emission concentrations, as calculated with the above equation, do not exceed the emission standards on a twelve-hour rolling average basis. These operating parameters should limit the ratio of the bypass stack flowrate to the combined bypass and main stack flowrate such that the emission standard is complied with on a twelve-hour rolling average basis.

23.3 Alternative Hazardous Waste Feedrate-Based Standards for Mercury and Chlorine for Cement and Lightweight Aggregate Kilns

If you cannot achieve the emissions standards for mercury, SVM, LVM, or chlorine when using MACT controls because of raw material contributions of metals or chlorine,you may petition the Administrator to comply with alternative requirements. See §63.1206(b)(9-10). The alternative requirements establish feedrate limits on metals and chlorine in the hazardous waste to ensure that hazardous waste contributions do not result in an exceedance of the emission standards.

23.4 Kilns That Feed Hazardous Waste at a Location Other Than the Hot End of Kiln[18]

Cement kilns or lightweight aggregate kilns that feed hazardous waste at a location other than the end where products are normally discharged and where fuels are normally fired (e.g., at the mid kiln or cold, upper end of the kiln) must comply with either:

- A HC standard at the main stack of 20 ppmv.

- For short kilns, a HC standard of 10 ppmv at a preheater tower location, and a HC standard of 10 ppmv at the alkali bypass duct (as long as hazardous waste is not fed downstream of the preheater tower HC sampling location).

This is because of the concern that hazardous waste could be fired into a location where such organic HAP in the waste may be merely evaporated or thermally cracked to form pyrolysis byproducts rather than be completely combusted. If this occurs, there is the potential that little CO will be generated even though significant HCs are being emitted. CO monitoring would thus not ensure that organic hazardous air pollutant emissions are being properly controlled.

Note that for kilns with a bypass or bypass sampling system, if the hazardous waste is fed at a location downstream of the bypass, compliance with the HC standard must be demonstrated at the main stack or preheater tower (at a location downstream of hazardous waste firing).

In addition, kilns that feed hazardous waste at a location other than the end where products are normally discharged and where fuels are normally fired must demonstrate

[18] We note that this is an existing provision of the Interim Standards and was not reopened by the April 20, 2004 proposed rule. We are including this information in this document for completeness.

compliance with the DRE standard every five years (i.e., in every comprehensive performance test). See §63.1206(b)(7)(ii). This is required because of the concern that, due to the unique design and operation of the waste firing system, and due to the decreased residence time and potential for varying levels of temperature and turbulence, the DRE may vary over time, and those variations cannot be identified or limited through operating limits set during a single DRE test. The rule provides an exception to this requirement, however, if you achieve the DRE standard for three consecutive comprehensive performance tests. If the design, operation, and maintenance of the source (relevant to achieving the DRE standard) was similar over the period of the three tests, you are no longer required to conduct DRE testing provided that you do not change the design, operation, or maintenance of the source subsequent to the third test in a manner that could adversely affect DRE. See §63.1206(b)(7)(ii)(B).

23.5 Facilities That Feed Low Levels of Metal or Chlorine

Performance testing requirements for one or more of certain HAP (mercury, semivolatile metals, low volatile metals, or chlorine) can be waived for sources that feed levels of these HAP that are sufficiently low so that the emissions standard(s) would not be exceeded even if it is assumed that all HAP fed to the system (in all feedstreams) were emitted from the stack. This assures compliance with the emissions standard because, unlike organic HAP, metals and total chlorine are conserved in the combustion process: they can neither be created nor destroyed. All of these species which are fed to the combustor must ultimately be emitted or captured. Thus, it is conservative to assume that everything that is fed to the system is emitted. This is analogous to the "Tier 1" approach used in the RCRA BIF rule.

This waiver can be implemented by one of three approaches:

1) A single maximum total feedstream feedrate limit for each HAP (or group of HAP) and a single minimum stack gas flow rate are established such that the ratio of the HAP feedrate to the stack gas flowrate (i.e., the MTEC), when converted to the appropriate units, does not exceed the emissions standard.

2) Operation would be allowed under different modes, each with its own single maximum total feedstream feedrate limit for each HAP (or group of HAP) and single minimum stack gas flow rate established and complied with as discussed under approach 1) above. Sources using this approach must clearly identify in the operating record which operating mode is in effect at all times, and must properly adjust their automatic waste feed cutoff levels accordingly.

3) Uncontrolled stack gas emission concentrations can be continuously calculated, assuming all metals or chlorine fed to combustion unit are emitted out the stack. Sources using this approach must record these calculated values and comply with the associated emission standards. This approach provides greater operational flexibility, but increases recordkeeping since the uncontrolled emission level must be continuously recorded and

included in the operating record for compliance purposes.

To document compliance under this waiver, a source must continuously monitor and record the feedrates of the above listed HAP and continuously monitor and record the gas flowrate. If operating under approach 1 or 2 above, both the flue gas flowrate and the HAP feedrates must be interlocked to trigger an AWFCO if their limits are exceeded. If operating under approach 3 above, the calculated uncontrolled HAP emissions must be interlocked to trigger an AWFCO if their values exceed their emissions standards.

A source which intends to claim this waiver provision, must, in its performance test workplan, document its intent to use this provision and explain which implementation approach is used. Similarly, its Notification of Compliance must specify which implementation method is used, and must incorporate the minimum stack gas flowrate and maximum metal and/or chlorine feedrate as operating parameter limits, or include a statement which specifies that it will comply with emission standard(s) by continuously recording its uncontrolled metal and/or chlorine emission rate.

When a source is operating under this waiver, it is not required to establish or comply with operating parameter limits associated with the metals or chlorine for which the waiver is claimed. For example, a source operating under this waiver for chlorine will not be required to comply with wet scrubber operating parameter limits for chlorine. Note, however, that operating under this waiver for SVM or LVM does not relieve a facility from establishing or complying with operating limits for particulate matter (which is a surrogate for other metal HAP not included in the SVM and LVM groupings).

A surrogate (e.g., cement kiln production rate) may be used in place of stack gas flow rate. However, the source must provide data in its performance test workplan that clearly and reasonably correlate the surrogate parameter to stack gas flow rate.

When operating under this waiver, metal and chlorine feedstream concentrations (with the exception of mercury in cement kiln or lightweight aggregate kiln raw materials) which are measured below the detection limit must be treated as if they were at the full detection limit. The more conservative full-detection-limit assumption is needed to provide an additional level of assurance that emissions from facilities operating under this waiver still reflect MACT and do not pose a threat to human health and the environment.

It is not appropriate, for purposes of this performance test waiver provision, to require a cement kiln or lightweight aggregate kiln to assume mercury is present at the full detection limit in its raw material when the feedstream analysis determines mercury is not present at detectable levels As a result, kilns are allowed to assume mercury is present at one-half the detection limit in raw materials when demonstrating compliance with the performance test waiver provisions whenever the raw material feedstream analysis determines that mercury is not present at detectable levels.

23.6 Operating Under Different Modes

Under some circumstances, sources may be subject to one set of operating limits in one mode of operation and another set of operating limits in another mode of operation. Different modes of operation are sometimes required. For example, cement kilns with an in-line raw mill must operate in one mode when the raw mill is on and another when it is off. In other situations, although not required, different modes of operation may provide a facility with more flexibility where operating limits must be established on conflicting parameters. For example, an incinerator with a fixed-throat venturi scrubber for particulate control may have difficulty complying with the limit on maximum flue gas flowrate and the limit on minimum pressure drop across the wet scrubber over a wide range of loads and wastes.

Operating parameter limits must be established for each mode of operation. A source must document in the operating record when it changes a mode of operation and must begin complying with the operating parameter limits for the alternative mode of operation.

There are three ways of calculating rolling averages when starting up in a new mode of operation:

- Retrieval approach – If the source has previously operated in the new mode, it does not have to restart its rolling averages. Rather, it may incorporate one-minute average values from the last time it operated in that mode so that there is no period of time when the rolling average limits (and associated AWFCOs) are not in effect.

- Start anew – Rolling averages are calculated anew (i.e., without considering recordings from the previous mode). Rolling averages are calculated using the amount of available data, until enough one-minute averages are available to calculate the 1 or 12-hour rolling averages as applicable. This procedure may not be used if the most recent operation in this mode resulted in an exceedance of a CEMS or CMS operating limit prior to the hazardous waste residence time expiring.

- Seamless transition – Rolling averages continue to be calculated using data from the previous operating mode, provided that both the operating limit and averaging period for the operating parameter are the same for both modes of operation.

If there is a transition period between one mode and another (i.e., a period of time when the source is in the process of changing modes), to assure that operating limits are achievable in the transition period, it is left to the discretion of the source to "define" when one mode stops and the next one begins. At that point, the source must begin complying with the operating limits of the new mode. If a source has conflicting operating limit parameters (e.g., an upper limit on flue gas flow rate and a lower limit on pressure drop across a fixed throat venturi scrubber) and the modes are sufficiently different so that there is no overlap, the source can use its discretion to "define" when one mode starts and the next one begins separately for each parameter.

For example, consider the case of a cement kiln with an ESP and an in-line raw mill which would have different operating limits in its two modes of operation for LVM, SVM, Hg, and total chlorine-related parameters:

- Maximum total feedrates of LVM, SVM, Hg, and total chlorine in all feedstreams
- Maximum total pumpable feedrates of LVM and SVM
- Minimum power to the ESP
- Maximum flue gas flowrate
- Maximum inlet temperature to the ESP

The cement kiln would conduct a comprehensive performance test under both modes of operation (raw mill on and raw mill off). It would demonstrate compliance with the LVM, SVM, Hg, and total chlorine standards for the combined modes on a time-averaged basis. Based on the two different modes in the performance test, it would establish limits on the above-listed operating parameters for each mode.

In this particular case, consider the situation where it turns out that the limits on maximum total and pumpable feedrates of LVM are more stringent for the raw-mill-off mode of operation. In preparation for the transition from raw-mill-on to raw-mill-off, the facility reduces its LVM feedrate (by reducing its hazardous waste feedrate, or by switching to a lower-LVM waste) so that the LVM feedrate is below the more stringent LVM limit for the raw-mill-off mode. The source then begins its transition to the raw-mill-off mode of operation. It decides at its discretion exactly when the new mode begins. At that time, it switches its AWFCO settings to the new mode, it designates in its operating record the exact time which the switch-over occurred, and it begins calculating its rolling average compliance parameters for the new mode. For example, for LVM feedrate (a 12-hour rolling average limit) the source stops tallying the 12-hour rolling average for the raw-mill-on mode; rather, the LVM feedrate for the first minute of operation under the raw-mill-off mode is added to the last 11 hours and 59 minutes of operation from the last time the source operated in a raw-mill-off mode.

23.7 Alternative to the Particulate Matter Standard for Incinerators and Boilers

Incinerators, solid fuel boilers, and liquid fuel boilers may comply with an alternative to the MACT PM standard. See §§63.1206(b)(14), 63.1219(e), 63.1216(e), and 63.1217(e). The alternative standards ensure that the nonenumerated metal HAP that would otherwise be controlled by the PM standard are controlled to levels such that all SVM (including nonenumerated Se) and all LVM (including nonenumerated Co, Mn, Ni, and Sb) are controlled to the levels of the SVM and LVM standards.

Sources complying with the alternative to the MACT PM standard will remain subject to the RCRA PM standard of 0.08 gr/dscf under their RCRA permit, however.

23.8 Alternative Monitoring Options

Sources can petition for alternatives to CMS requirements – including alternative CMS operating parameters, or alternative CEMS.

23.8.1 Alternative Operating Parameters

§63.1209(g)(1) provides a mechanism for petitioning the Agency for use of an alternative monitoring method (i.e., an alternative to the CMS-based operating parameter limit requirements). The alternative monitoring provisions of §63.8(f) have been incorporated into §63.1209(g)(1) to explicitly allow the permitting authority to approve minor changes as defined by §63.90(a). Note that a request to use a PM CEMS is considered to be an intermediate change and a petition to use another type of CEMS (e.g., multimetal CEMS or HCl CEMS) is considered to be a major change. Consequently, requests to use CEMS must follow procedures under 63.8(f) (as specified by §63.1209(a)(5)) and must be approved by the Agency rather than the delegated permitting authority.

The source must submit a petition under §63.1209(g)(1) to the permitting authority not later than with the comprehensive performance test plan. It is recommended that it be included with the comprehensive performance test plan. The petition must include:

- Data or information justifying the request for an alternative monitoring requirement (or for a waiver of an operating parameter limit), such as the technical or economic infeasibility or the impracticality of using the required approach.

- A description of the proposed alternative monitoring requirement, including the operating parameter to be monitored, the monitoring approach/technique (e.g., type of detector, monitoring location), the averaging period for the limit, and how the limit is to be calculated.

- Data or information documenting that the alternative monitoring requirement would provide equivalent or better assurance of compliance with the relevant emission standard, or that it is the monitoring requirement that best assures compliance with the standard and that it is technically and economically practicable.

The permitting authority should notify the source with approval or intention to deny approval of the request within 90 calendar days after receipt of the original request and within 60 calendar days after receipt of any supplementary information that is submitted. The permitting authority will not approve an alternative monitoring request unless the alternative monitoring requirement provides equivalent or better assurance of compliance with the relevant emission standard, or is the monitoring requirement that best assures compliance with the standard and that is technically and economically practicable. Before disapproving any request, the permitting authority will notify facilities of the permitting authority's intention to disapprove the request together with: (1) notice of the information and findings on which the intended disapproval is based; and (2) notice of opportunity to present additional information to the permitting authority before final action on the request. At the time the permitting authority notifies of intention to disapprove the request, the permitting authority will specify the date by which a facility must submit the additional information if it wished it to be considered in the final action.

The facility is responsible for ensuring that any supplementary and additional information supporting a petition is submitted in a timely manner to enable the permitting authority to consider the petition during review of the comprehensive performance test plan. Neither submittal of a petition, nor the permitting authority's failure to approve or disapprove the petition, relieves a facility of the responsibility to comply with the provisions of the rule.

23.8.2 Use of Alternative CEMS

A source may petition the Agency to use CEMS for compliance monitoring for particulate matter, mercury, semivolatile metals, low volatile metals, and total chlorine (hydrochloric acid and chlorine gas) under §63.8(f) (as specified by §63.1209(a)(5)) in lieu of compliance with the corresponding operating parameter limits. The alternative monitoring provisions of §63.8(f) continue to apply to CEMS because implementation of those provisions is not eligible to be delegated to the permitting authority at this time.

The use of alternative CEMS for compliance with standards is highly encouraged. Potential incentives for the use of alternate CEMS include: emissions testing would not be required; limits on operating parameters would not apply while the CEMS is in service; and the feedstream analysis requirements for the parameters measured by the CEMS (i.e., metals or chlorine) would not apply. However, in most cases, operating parameter limits may still need to be set based on performance testing because most facilities will probably elect to comply with operating parameter limits during CEMS malfunctions. However, a second, back-up CEMS could be another alternative.

23.9 Data Compression

The use of data compression to reduce the amount of information that must be recorded and kept in the operating record may be requested as part of the comprehensive performance test plan. For each CEMS or CMS reading, the following must be provided:

- Fluctuation limit which defines the maximum permissible deviation of a new data value from a previously generated value without requiring to record 1 minute averages.

- Data compression limit, defined as the closest level to an operating parameter or emission standard at which reduced recording is allowed.

23.10 Alternative Health-Based Standard for Total Chlorine in Lieu of the MACT Standard

All hazardous waste combustors with the exception of HCl Production Furnaces may comply with an alternative health-based standard for total chlorine in lieu of the MACT Standard. See §63.1215. Also see Volume III, Section 24 of this series of Technical Support Documents.

References

W.S. Lanier, F.M. Stevens, B.R. Springsteen, and W.R. Seeker, "Dioxin Compliance Strategies for the HWC MACT Standards," *Proceedings of the 1996 Incineration Conference*, Savannah, GA, May 6-10, 1996, pp. 587-593). OAR – 2004 – 0022 - 0073

J.D. Kilgroe and T.G. Brna, "Control of PCDD/PCDF Emissions from Municipal Waste Combustion Systems," *Chemosphere*, Vol. 20, No. 10-12, pp. 1875-1882, 1990). OAR – 2004 -0022 - 0076

W.S. Lanier and T.R. von Alten, "Investigation into the Discrepency between MWI and MWC CDD/CDF Emissions," *Proceedings of the 1992 Incineration Conference*, Albuquerque, NM, May 11-15, OAR – 2004 – 0022 - 0074

V. Boscak and G. Kotynek, "Techniques for Dioxin Emission Control," *2nd Annual International Specialty Conference on Municipal Waste Combustion*, Air and Waste Management Association, pp. 383-398, Tampa, FL, April 15-19, 1991). OAR – 2004 – 0022 - 0077

U.S. EPA, "Guidance on Quality Assurance Project Plans," EPA QA/G-5, U.S. EPAQuality Assurance Management Staff, September 1997.

U.S. EPA, "U.S. EPA Requirements for Quality Assurance Project Plans (QAPPs) for Environmental Data Operations," Draft Interim Final, EPA QA/R-5, U.S. EPA Quality Assurance Management Staff, August 1994.

U.S. EPA, "Handbook: Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration," EPA/625/6-89/023, January 1990.

U.S. EPA, "Engineering Handbook for Hazardous Waste Incineration," EPA-SW-889, NTIS #PB81-248163, September 1981.

U.S. EPA, "Handbook: Operation and Maintenance of Hospital Medical Waste Incinerators," EPA/625/6-89/024, January 1990.

U.S. EPA, "Guidance for Permit Writers, Facilities Storing Hazardous Waste in Containers," NTIS # PB-88-105689, 1992.

Peray, K.E., "The Rotary Cement Kiln," Chemical Publishing Inc., New York, NY, 1986. Cement kiln O&M.

U.S. EPA, "Wet Scrubber Inspection and Evaluation Manual," EPA 340/1-83-022, NTIS # PB 85-149375, September 1983.

U.S. EPA, "Operation and Maintenance Manual for ESPs," EPA/625/1-85/017,NTIS# PB 86-216785,. September 1985.

U.S. EPA, "Operation and Maintenance Manual for Fabric Filters," EPA/625/1-86/020, June 1986. NTIS #PB88 – 180120, Fabric filter O&M.

McKenna, J.D. and Turner, J.H., 1989 "Fabric Filter - Baghouses I, Theory Design and Selection," ETS, Inc., Roanoke, VA, Fabric filter O&M.

Greiner, G.P., "Fabric Filter - Baghouses II, Operation, Maintenance, and Troubleshooting," ETS, Inc., 1989. Fabric filter O&M., Salem,VA, Valley Printers

Heumann, W.L., "Industrial Air Pollution Control Systems," McGraw-Hill, 1997. Fabric filter, wet scrubber, and electrostatic precipitator O&M. ISBN #0070314306

U.S. EPA, "Waste Analysis at Facilities That Generate, Treat, Store, and Dispose of Hazardous Wastes: A Guidance Manual," U.S. EPA Office of Solid Waste and Emergency Response, OSWER 9938.4-03, PB94-963603, April 1994.

U.S. EPA, "Waste Analysis Guidance for Facilities That Burn Hazardous Wastes (Draft)," U.S. EPA Enforcement and Compliance Assurance (2224A), EPA 530-R-94-019, October 1994.

Appendix A

Notification of Compliance Sample Forms

Worksheet Forms:

- System Design
- Condition Description
- Stack Gas Emissions
- Operating Conditions
- Feedstreams

COMBUSTOR	
Manufacturer/Model No.	
Unit ID No./Name	
Date in Service	
Incinerator	
Incinerator Type/Design	
Dimensions	
Other Characteristics	
Ash/Slag Handling, Disposal Practices	
Cement Kiln	
Kiln Dimensions	
Process Type (dry, wet, long, short)	
Preheater or Precalciner Description	
In-line Raw Mill Description	
Other Characteristics	
Dry Raw Material Feedrate (tons/hr)	
Clinker Production Rate (tons/hr)	
CKD Recycle Rate (tons/hr)	
Lightweight Aggregate Kiln	
Kiln Dimensions	
Other Characteristics	
Dry Raw Material Feedrate (tons/hr)	
Aggregate Production Rate (tons/hr)	
Liquid and Solid Fuel Boiler	
Boiler Type	
Dimensions	
Other Characteristics	
Ash Handling, Disposal Practices	
HCl Production Furnace	
Furnace Design	
Dimensions	
Other Characteristics	
Ash Handling, Disposal Practices	
General Combustor Characteristics	
Thermal Input Capacity (MMBtu/hr)	
Hazardous Waste Types	
Non Hazardous Waste Fuel Types	
Other Feedstreams	
Combustion Temperature(s) (F)	
Combustor Pressure (in H_2O)	
Residence Time	
Solids (min)	
Flue Gas (sec)	
Combustor Feedstreams	
Feedstream 1	
Description	
Feed Location	
Feed Mechanism	
Feedrate (lb/hr)	
Feedstream 2	
Description	

Feed Location
Feed Mechanism
Feedrate (lb/hr)
Feedstream 3
Description
Feed Location
Feed Mechanism
Feedrate (lb/hr)
Feedstream 4
Description
Feed Location
Feed Mechanism
Feedrate (lb/hr)
Feedstream 5
Description
Feed Location
Feed Mechanism
Feedrate (lb/hr)
Feedstream 6
Description
Feed Location
Feed Mechanism
Feedrate (lb/hr)
Feedstream 7
Description
Feed Location
Feed Mechanism
Feedrate (lb/hr)
AIR POLLUTION CONTROL DEVICES
General Air Pollution Control Devices
Fabric Filter
Manufacturer/Model No.
Unit ID No.
Date in Service
Fabric Cloth Type / Weave
Housing Geometry
Number of Compartments
Number of Bags Per Cell
Bag Size (length, diameter)
Cloth Area (ft^2)
Flue Gas Flowrate (acfm)
Flue Gas Temperature (min/max)
Air to Cloth Ratio (ft/min)
Pressure Drop (min/max) (in H_2O)
Cleaning Procedure
Cleaning Frequency
Cleaning Duration
Design PM Emissions (gr/dscf)
Electrostatic Precipitator
Manufacturer/Model No.
Unit ID No.

Date in Service	
ESP Type / Design	
Housing Geometry	
Flue Gas Conditioning	
Fields	
Electrode Type	
Plate/Wire Spacing (ft)	
Plate Area (ft^2)	
Flue Gas Flowrate (acfm)	
Flue Gas Temperature (min/max)	
Specific Collection Area (ft^2/kacfm)	
Voltage (for each field) (kV)	
Current (for each field) (A)	
Spark Rate	
Rapping Procedure	
Raping Duration	
Raping Frequency	
Design Emissions (gr/dscf)	
Wet Scrubber	complete separately for each different scrubber
Manufacturer/Model No.	
Unit ID No.	
Date in Service	
Scrubber Type / Design	
Scrubber Dimensions	
Packing Type	
Scrubber Pressure Drop	
Flue Gas Temperature (F)	
Flue Gas Flowrate (acfm)	
Liquid Injection Rate (gal/hr)	
Liquid to Gas Ratio (gal/kacf)	
Liquid Type	
Liquid pH	
Liquid Injection Procedure	
Liquid Blowdown Rate (gal/hr)	
Liquid Tank Volume (gal)	
Liquid Solids Content (%)	
Liquid Treatment Procedures	
Design PM Performance (gr/dscf)	
Design Acid Gas Performance	
Dry Scrubber	also applicable to activated carbon injection
Manufacturer/Model No.	
Unit ID No.	
Date in Service	
Dry Scrubber Type/Design	
Flue Gas Temperature (max/min) (F)	
Sorbent Injection Rate (lb/hr)	
Flue Gas Flowrate (dscfm)	
Sorbent Type	
Sorbent Preparation / Supplier	
Sorbent Properties	
Sorbent Injection Procedure	

Sorbent Injection Pressure (psi)
Sorbent Recycle Rate (lb/hr)
Design Acid Gas Performance
Boiler / Heat Exchanger
Manufacturer/Model No.
Unit ID No.
Date in Service
Type / Design
Design / Geometry
Heat Exchange Fluid
Flue Gas Temperature (Inlet/Outlet) (F)
Heat Exch Fluid Temp (Inlet/Outlet) (F)
Sootblowing Duration/Frequency (min)
Water Spray Cooling
Manufacturer/Model No.
Unit ID No.
Date in Service
Spary Cooler Type/Design
Flue Gas Temperature (Inlet/Outlet) (F)
Water Injection Rate (lb/hr)
Fan
Manufacturer/Model No.
Unit ID No.
Date in Service
Type / Design
Speed (RPM)
Power (kW)
Blade Diameter (ft)
Pressure Rise (in H_2O)
Operating Temperature (F)
Stack
Height From Ground Level (ft)
Diameter at Top (ft)
Stack Gas Exit Temperature (F)
Stack Gas Exit Flowrate (acfm)

Condition Description

	Run No.		
	1	2	3
Condition No.			
Condition Description / Purpose			
Stack Gas and Feedrate Measurements			
Date			
Start Time			
End Time			
Condition No.			
Condition Description / Purpose			
Stack Gas and Feedrate Measurements			
Date			
Start Time			
End Time			
Condition No.			
Condition Description / Purpose			
Stack Gas and Feedrate Measurements			
Date			
Start Time			
End Time			

Stack Gas Emissions

Emissions

Test Condition No. _______________ Measurement Location _______________________

	Units	Run No. 1	Run No. 2	Run No. 3	Cond Avg
Stack Gas Conditions					
Gas Flowrate	dscfm				
Oxygen	%				
CO_2	%				
Moisture	%				
Temperature	F				
CO					
Run Average	ppmv @ 7% O_2				
Max Hr Roll Avg	ppmv @ 7% O_2				
Max 1 Min Avg	ppmv @ 7% O_2				
HC					
Run Average	ppmv @ 7% O_2				
Max Hr Roll Avg	ppmv @ 7% O_2				
Max 1 Min Avg	ppmv @ 7% O_2				
Particulate Matter	gr/dscf @ 7% O_2				
Total Chlorine	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
HCl	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Cl_2	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Mercury	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Semivolatile Metals	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Lead	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Cadmium	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Low Volatile Metals	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Chromium	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Arsenic	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Beryllium	ug/dscm @ 7% O_2				
	lb HW/MM Btu HW				
Polychlorinated Dioxins and Furans (PCDD/PCDF)					
TEQ	ng/dscm @ 7% O_2				
Total	ng/dscm @ 7% O_2				
POHC DRE (%)					
POHC No. 1 (add name)					

POHC No. 2 (add name)						
POHC No. 3 (add name)						
POHC No. 4 (add name)						
POHC No. 5 (add name)						
Non-Enumerated Metals						
Antimony	ug/dscm @ 7% O_2					
Cobalt	ug/dscm @ 7% O_2					
Manganese	ug/dscm @ 7% O_2					
Nickel	ug/dscm @ 7% O_2					
Selenium	ug/dscm @ 7% O_2					

<u>Notes:</u>
Indicate non-detect measurements with a "<"
PCDD/PCDF TEQ -- Toxic Equivalents
PCDD/PCDF Total -- Total sum of all congeners and isomers

Operating Conditions

Test Condition No. ___________________

Parameter	Units	Avg Period	Run No. 1	2	3	Cond Avg
Combustor						
Combustion Temperature						
Location 1 / Description	F	Run Avg				
	F	Max 10 min				
Location 2	F	Run Avg				
	F	Max 10 min				
Location 3	F	Run Avg				
	F	Max 10 min				
Waste Feedrate						
Location 1 / Description						
Pumpable	lb/hr	Run Avg				
Total	lb/hr	Run Avg				
Location 2 / Description						
Pumpable	lb/hr	Run Avg				
Total	lb/hr	Run Avg				
Location 3 / Description						
Pumpable	lb/hr	Run Avg				
Total	lb/hr	Run Avg				
Ash Feedrate	lb/hr	Run Avg				
Chlorine Feedrate	lb/hr	Run Avg				
Mercury Feedrate	lb/hr	Run Avg				
Low Volatile Metals Feedrate						
Pumpable	lb/hr	Run Avg				
Total	lb/hr	Run Avg				
Semivolatile Metals Feedrate						
Pumpable	lb/hr	Run Avg				
Total	lb/hr	Run Avg				
Flue Gas Flowrate	acfm	Max HRA				
Production Rate	tons/hr	Max HRA				
Combustor Operating Pressure	in H_2O	Max Inst				
Liquid Waste Firing System						
Burner Atomization	psig	Run Avg				
Liquid Waste Viscosity	poise	Run Avg				
Batch Feed Operation						
Batch Size	lb	Max				
O2 Prior to Batch	%	Max				
Batch Feed Frequency	batch/hr	Max				
Air Pollution Control Devices						
Wet Scrubber (for each different scrubber)						
Pressure Drop	in. H_2O	Run Avg				
Liquid to Gas Ratio	gal/kacf	Run Avg				
Liquid Feedrate	gpm	Run Avg				
Flue Gas Flowrate	acfm	Run Avg				
Liquid pH		Run Avg				
Liquid Blowdown Rate	gpm	Run Avg				

System Operating Conditions

Test Condition No. ____________________

Parameter	Units	Avg Period	Run No. 1	2	3	Cond Avg
Liquid Tank Volume	gal					
Liquid Solids Content	wt. %	Avg				
Liquid Feed Pressure	psig	Run Avg				
Sorbent Injection (Calcium, Sodium, Activated Carbon)						
Sorbent Type/Properties						
Sorbent Injection Rate	lb/hr	Run Avg				
Carrier Gas Flowrate	acfm	Run Avg				
Nozzle Pressure	psig	Run Avg				
Flue Gas Temperature	F	Run Avg				
Dry PM APCD						
Inlet Flue Gas Temperature	F	Max HRA				
Heat Exchanger / Waste Heat Boiler						
Flue Gas Temperature						
Inlet	F	Run Avg				
Outlet	F	Run Avg				

Feedstreams

Feedstream Characterization

Test Condition No. ____________ Run No. ___________

Stream No.	Units	1	2	3	4	5	6	7	8	Total
Description										
Mass Feedrate	lb/hr									
Thermal Feedrate	MMBtu/hr									
Viscosity	poise									
Ash	lb/hr									
Chlorine	lb/hr									
Mercury	lb/hr									
Low Volatile Metals	lb/hr									
Arsenic	lb/hr									
Beryllium	lb/hr									
Chromium	lb/hr									
Semivolatile Metals	lb/hr									
Cadmium	lb/hr									
Lead	lb/hr									
Non-Enumerated Metals										
Antimony	lb/hr									
Cobalt	lb/hr									
Manganese	lb/hr									
Nickel	lb/hr									
Selenium	lb/hr									
Principal Organic Hazardous Constituent										
POHC 1 (name)	lb/hr									
POHC 2 (name)	lb/hr									
POHC 3 (name)	lb/hr									
POHC 4 (name)	lb/hr									

APPENDIX B.
DOWNWARD EXTRAPOLATION OF METAL FEEDRATES

Summary

In the MACT rule as currently proposed,

- Units with dry APCDs
  - Can determine SVM SRE from a CPT conducted at emissions levels that are higher than the yearly rolling average limits, and use this SRE to extrapolate downward (implicitly assuming that emissions are proportional to feedrate) to establish a feedrate limit that would comply with the emissions limit. *As discussed below, the potential error introduced by downward extrapolation for SVM is very small; thus downward extrapolation for SVM is appropriate.*
  - Must assume an SRE of zero for mercury

- Units with wet scrubbers can extrapolate downward based on SRE for both Hg and SVM.
  - *As discussed below, for SVM the same principles apply to wet scrubbers as for dry APCD. The potential error introduced by downward extrapolation for SVM is very small and downward extrapolation for SVM is appropriate.*
  - *As discussed below, with some caveats, downward extrapolation for mercury is conservative and appropriate.*

Background

The mercury and SVM standards for liquid fuel boilers are based on normal emissions.[1] These sources are permitted to maximize controllable operating parameters during the comprehensive performance test to reflect variability of those parameters (e. g., by spiking metals) to calculate an SRE and establish a feedrate limit. Given that exceeding the MACT emission standard during the comprehensive performance test is allowed because the standard is based on an annual average, downward extrapolation of the performance test feedrate is permissible to calculate a feedrate limit with an (not-to-exceed) annual averaging period.

This discussion explains why downward extrapolation of mercury and SVM feedrates for liquid fuel boilers is appropriate.

Dry APCDs

<u>Simplified Approach</u>
The emissions versus feedrate curve for a given metal HAP for a given facility depends on several factors such as combustion temperature, residence time, APCD type, and the concentration of oxygen, chlorine, sulfur and other species in the gas stream.

---

[1] At proposal, the mercury standards for CKs and LWAKs were also based on normal emissions.

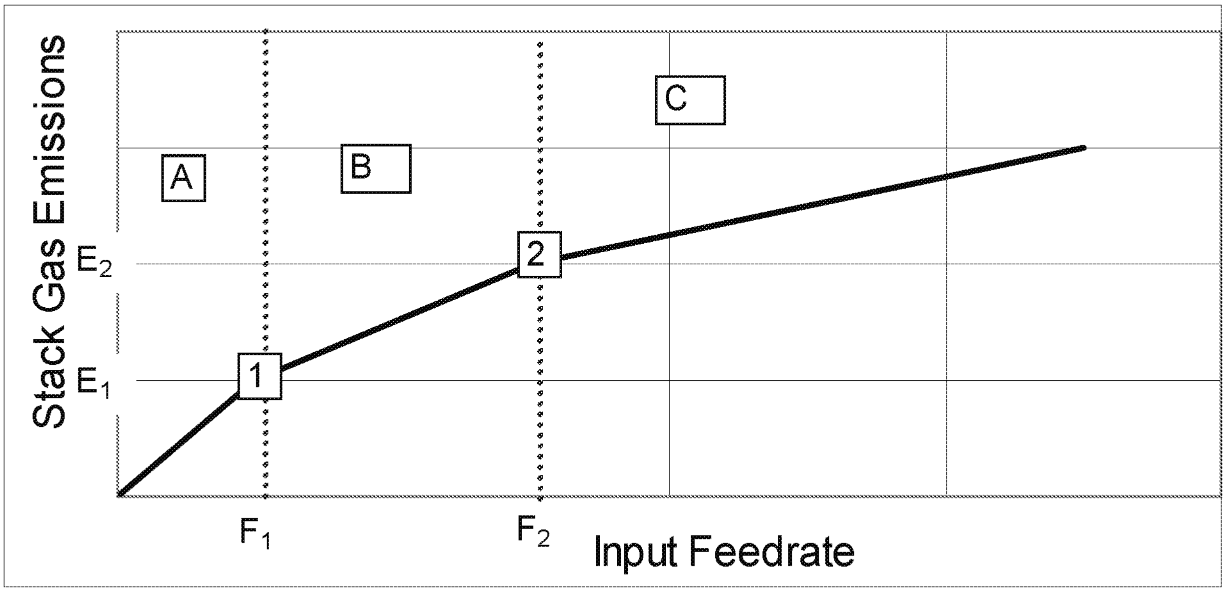


Figure 1. Theoretical Relationship between Stack gas Emissions and Feedrate.

A theoretical plot of stack gas emissions as a function of metal feedrate for a facility with a dry APCD would look like the one shown in Figure 1. In general there will be three regions.

Region A: (Extends from the origin to point 1). At low enough feedrates all the metal exist in the vapor phase. Vapor-phase metals will generally pass through FFs and ESPs resulting in an SRE of zero. For such metals control may be achievable by specialized techniques such as wet scrubbing or carbon adsorption.

Region B: (Extends from points 1 to 2) With increasing metal feedrates, the flue gas becomes saturated with metal vapor at the APCD temperatures, and additional metal injected will be in the condensed form either as fine fume or condensed onto fine particulate. At these feedrates some of the condensed metal can be captured in the APCD. The slope in region B depends on the APCD performance with more efficient devices producing shallower slope (a higher SRE). If no APCD is installed the SRE will stay at zero as in region A.

Region C: (To the right of point 2) At this point the saturated vapor pressure at the combustion temperature is reached and metals no longer vaporize in the combustor region, but remain in solid form in the bottom ash of incinerators, in the clinker in CKs and LWAKs, or as entrained coarse particulate matter. SRE is high since the metals partition to bottom ash or clinker (which never make it to the emissions) or to relatively large fly ash particles which are easily removed.

Therefore as seen in Figure 1, SRE generally increases with feedrate. This also illustrates why, in theory, downward extrapolation is generally non-conservative. For example, consider a comprehensive performance test that is conducted at a feedrate in region B or C that results in emissions exceeding the standard. Downward extrapolation through the origin will result in a higher feedrate limit than that given by the emissions vs, feedrate curve. (see Figure 2). However, as a practical matter, if the inflexion point in curve in Figure 2 is very close to the origin the "error" will be negligible.

The relative magnitude of the three regions (A, B, C) in Figure 1 depend on metal type and volatility. For a high volatile metal (like Hg or Se), region A dominates over a wide range of feedrates, since vapor pressures are high (on the order of millions of ug/dscm). For SVM region B dominates since vapor pressures for these metals at combustion temperatures are high. For LVM, region C dominates. Therefore location of the points of inflexion separating region A, B, and C will be useful in determining if downward extrapolation has a significant effect.

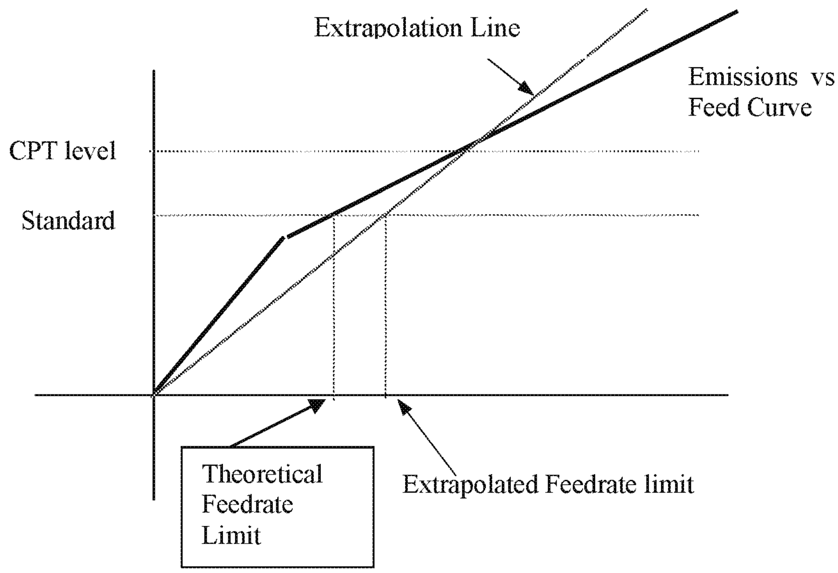


Figure 2. Downward Extrapolation.

<u>Vapor Phase Metal Equilibrium</u>

Equilibrium calculations were performed using the HSC equilibrium code. The goal was to find the theoretical feedrates and emissions (F_1, F_2, E_1, and E_2) for metals of different volatility. It was assumed that the hazardous waste combustor flue gas was made up of the products of combustion of methane with 20% excess air (approximately 4% oxygen on a dry basis). Computations were done with and without chlorine in the flue gas environment. The amount of chlorine selected (6.2×10^6 µg/dscm) corresponded to the average MTEC for liquid boilers.

Metal feedrate MTECs for liquid boilers in the HWC database were typically less than 1×10^5 µg/dscm. However, to ensure that metal vapor compositions were not limited by the amount of metal present about 0.01 kmol of metal (corresponding to an MTEC of 5×10^6 µg/dscm) was added to the system for the calculations. Figure 3 shows the equilibrium metal vapor pressures for the metals of concern (Hg, Cd, and Pb) with no chlorine present. The plot for Cr is also shown for reference. These vapor pressures are the sum of the vapor pressures of all gas phase species of the metal. The results indicate that, as expected mercury is highly volatile even at typical dry APCD temperatures of 400°F (~200 °C). For the SVM metals, Cd and Pb the equilibrium concentration (and hence vapor pressure) is relatively low at 200 °C but very high at combustion temperatures.

The results for the equilibrium calculations performed with some chlorine added to the flue gas are shown in Figure 4. The amount of chlorine added corresponded to the average feed MTEC for liquid boilers. The estimated equilibrium values at 200°C (~ 400°F, a typical dry APCD temperature) and 1000°C (1800 °F, a typical combustion temperature) are shown in table 1.

The calculations indicate that for mercury the equilibrium metal concentration increases even further in the presence of Cl. The Pb concentration also increases with chlorine but the impact on Cd is small over the temperature range considered.

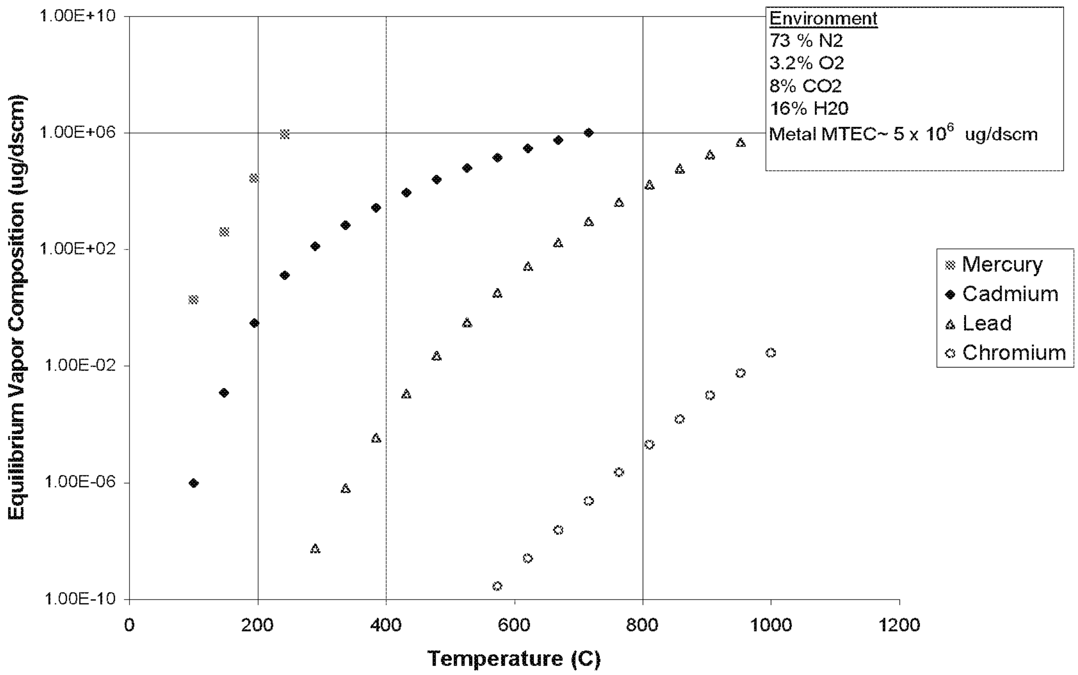


Figure 3. Equilibrium Metal Concentrations for a Chlorine Free Flue Gas Environment.

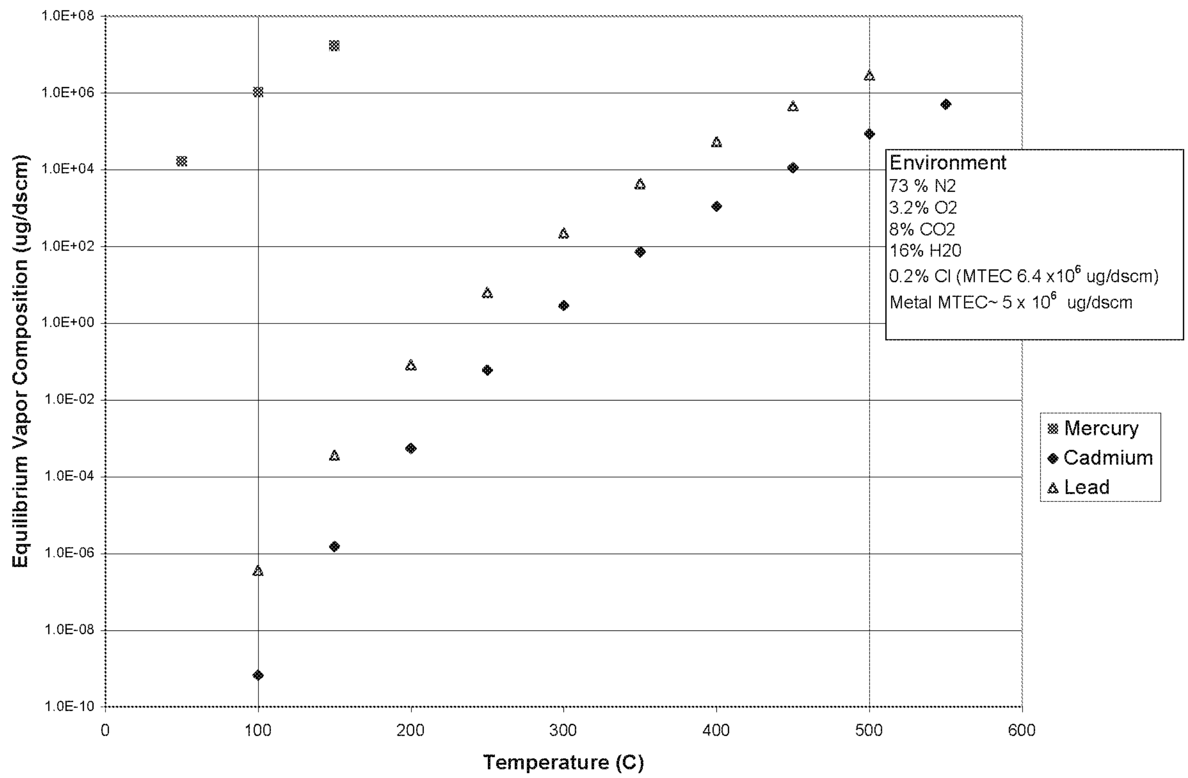


Figure 4. Equilibrium Concentrations for Hg, Cd, and Pb in Chlorinated Environment.

Table 1. Estimated Equilibrium Concentration at 200 °C and 1000°C based on HSC Program Calculations

	Estimated Equilibrium Composition ug/dscm				
	Without Cl2		With Cl2		
	200 °C	1000 °C	200 °C	1000 °C	Metallic Gas Phase Species Considered
Hg	4.36E+04	8.891E+14	7.39E+07	1.74E+12	HgO, Hg2, Hg, HgCl, HgCl2
Cd	2.962E-01	2.83E+08	4.25E-04	1.69E+11	Cd, Cd(OH), Cd(OH)2, CdH, CdO, CdCl, CdCl2
Pb	6.94E-15	2.03E+07	6.42E-02	4.46E+10	Pb(C2H5)4, Pb(CH3)4, Pb, Pb(H3), Pb2, PbH, PbO, PbCl, PbCl2, PbCl3
Cr	1.66E-20	2.83E-02			Cr(CO)6, Cr, Cr(OH)2, Cr(OH)3, Cr(OH)4, Cr2, Cr2O2, CrOH, CrO2, CrO, CrH
As	8.63E-08	2.99E+03			As4O6, As4O7, As2O3, As4O8, AsO, AsO2, As4O10, As4O9, As
Be	9.62E-14	1.18E-01			Be(OH)2, BeO, Be2O2, Be3O3, Be4O4, Be

<u>Emissions vs Feedrate for Metals of Interest</u>

The calculated values are used to construct a theoretical emissions vs, feedrate plot for Hg, Pb, and Cd .

If F_1, F_2, E_1, E_2 are the respectively the feeds and emissions associated with the points of inflection in Figure 1. F_1 and F_2 are directly derived from equilibrium calculations and are shown in Table 1. E_1 and E_2 can be calculated if the following simplifying assumptions are made,

a) The SRE for the metal fraction volatile at 200 °C is zero,
b) The SRE for the metal fraction volatile at 1000°C but non-volatile at 200 °C is 98%.
c) The SRE for the metal fraction non-volatile at 1000°C is 99.9%
The emissions can be calculated by:

Region A: E = F, so at point 1, $E_1 = F_1$

Region B: $\mathbf{E = E_1 + (F-F_1)*0.02}$, thus at point 2, $E_2 = E_1 + (F_2-F_1)*0.02$

Region C: $\mathbf{E = E_1 + (F_2-F_1)*0.02 + (F-F_2)*0.001}$

Using this technique the emissions vs. feedrate curve is derived (for the case with Chlorine in the feedstream) and plotted in Figure 5. The SVM standard for existing LFBs is 2.5E-5 lb/MMBtu[2]. Using an F-factor of 13,400 dscf/MMBtu this can be converted to an equivalent emissions standard of 36 ug/dscm and shown in the figure. The first inflexion point for Cd and Pb occurs at less than 0.07 ug/dscm which is well below the standard.

Table 2 lists the range of feed MTECs for metals for all hazardous waste combusting liquid boilers. From Table 2 and Figure 5 we can see that typical feedrates occur in

Table 2. Metal MTEC range for Liquid Boilers

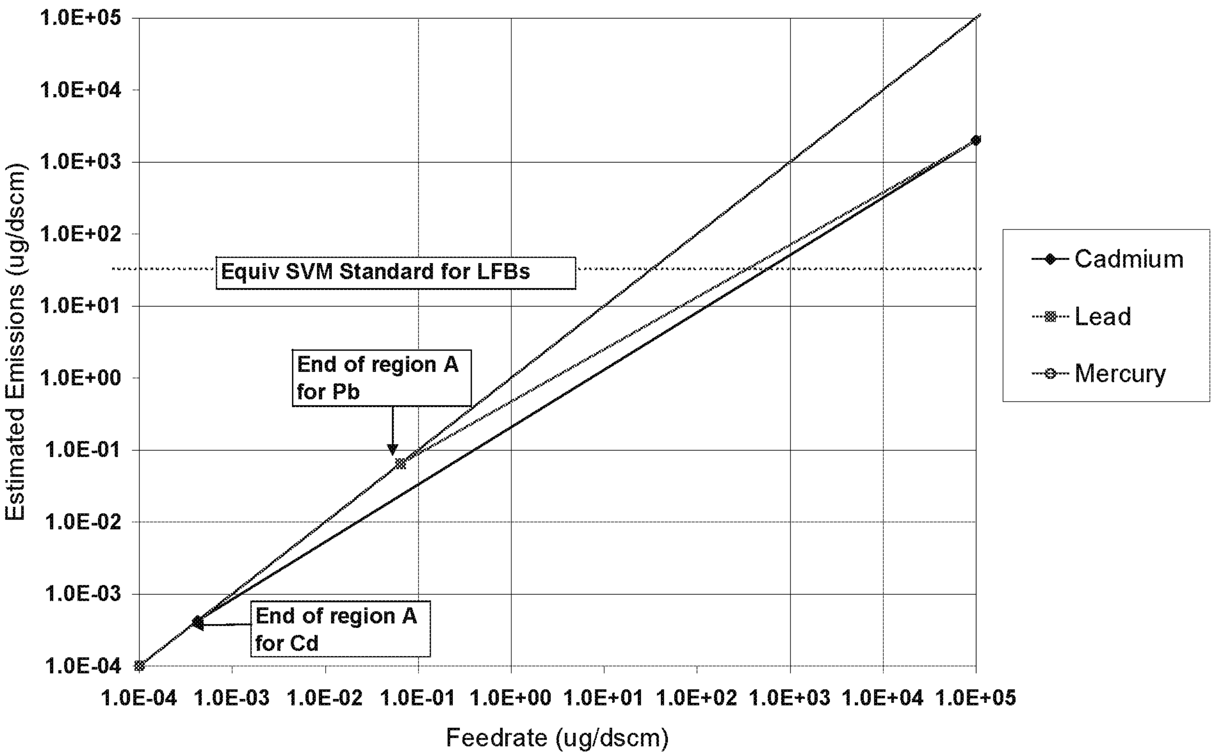
Feedrate MTECS for Liquid Boilers (ug/dscm)			
	SVM	LVM	Hg
Average	1171.3	721.7	107.6
Max	8.8E+04	1.9E+04	9.9E+03
Min	0.4	1.0	0.1

[2] Since this analysis was conducted the floors for liquid boilers have changed. For sources burning high energy waste the existing source floor is 8.2E-5 lb/MMBtu (equivalent of 99 ug/dscm) and for sources burning low energy waste the floor is 150 ug/dscm. However, since the analysis shown in table 3 shows very little error in downward extrapolation between feedrates that correspond to emissions in the range 36 to 3600 ug/dscm, the conclusions regarding downward extrapolation having little or no error are valid even for the revised standards.

region B for SVM and region A for mercury.

Figure 6 shows estimated emissions of lead vs. feedrate on a linear scale up to estimated emissions of about twice the 36 ug/dscm SVM emissions limit. From this figure we can observe

Figure 5:Theoretical Feedrate vs Emissions Plot From Equilibirum



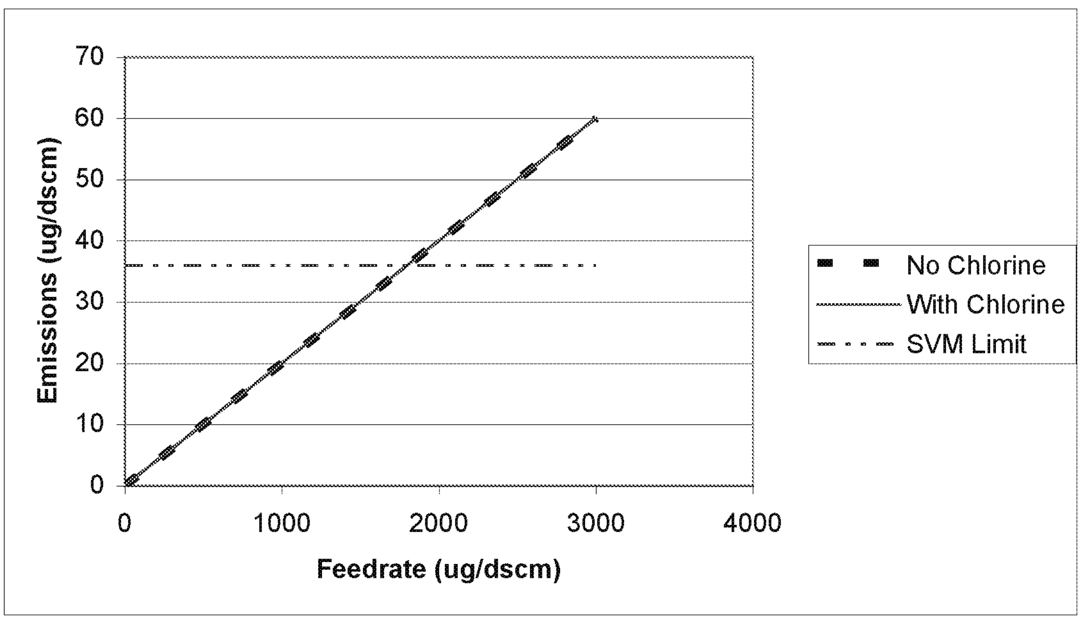


Fig 6: Predicted Effect of Pb Feedrate on Emissions

that the inflection point between region A and region B, when viewed on this scale, is very close to the origin; thus the emissions vs. feedrate line very nearly passes through the origin; thus the error introduced by downward extrapolation will be small. This is true with or without the presence of chlorine. Although the region A → region B inflection point occurs at an emissions concentration several orders of magnitude higher (6×10^{-2} vs 7×10^{-15} ug/dscm) when chlorine is present, both are negligible compared to the SVM emissions limit of 36 ug/dscm.

Figure 7 shows a similar plot for cadmium, leading to similar conclusions.

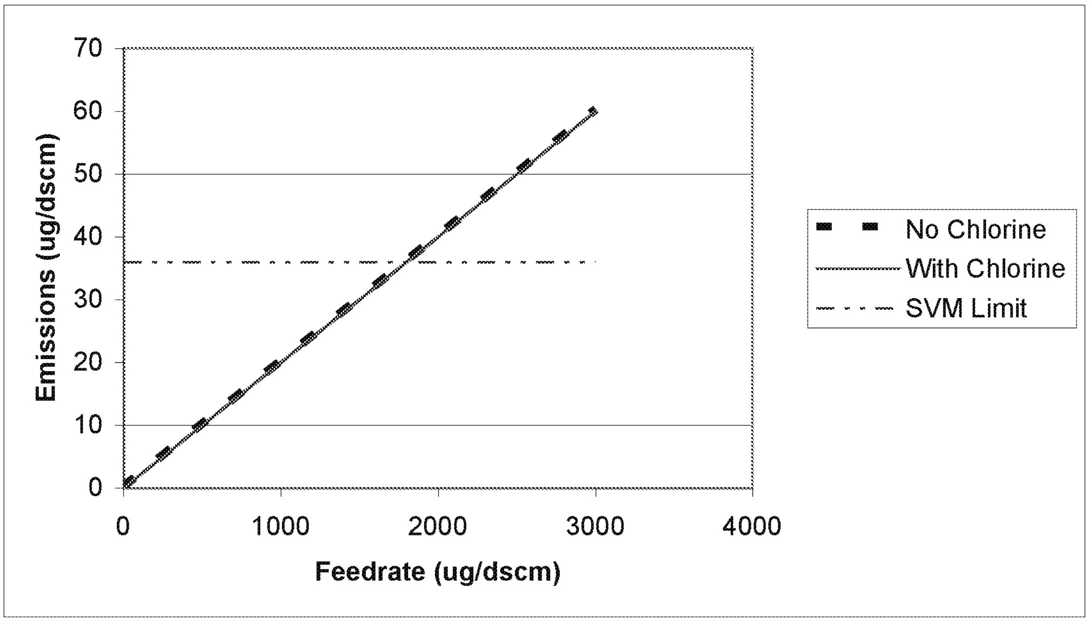


Fig 7 Predicted Effect of Cd Feedrate on Emissions

Using the equilibrium results, the error in downward extrapolation can be calculated. For lead, the feedrate corresponding to emissions of 36 ug/dscm is 1800 ug/dscm. Table 3 shows the error involved in the projected feedrate limit at various feedrates. If the emissions are double the standard the error in the projected feedrate is only 0.09%. At 100 times the emissions standard the error is still small (only 0.17%). One could infer from this that downward extrapolation only introduces a small error. Similar results were derived for cadmium. Thus, on a theoretical basis, any degree of downward extrapolation appears to be justified. However, from a practical viewpoint, it may be advisable to limit the level of extrapolation allowed. For

Table 3: Error in downward extrapolation for Pb

Equivalent Emissions Limit (ug/dscm)			36	
Theoretical Feedrate Limit (ug/dscm)			1,797	
Region B SRE			0.98	
Feed (ug/dscm)	Theoretical Emissions (ug/dscm)	SRE	Proj FL (ug/dscm)	% Error
1,797	36	97.9965%	1797	0.00%
3,594	72	97.9982%	1798	-0.09%
179,700	3594	98.0000%	1,800	-0.17%

example, downward extrapolation should be allowed provided that the emissions measured in the comprehensive performance test are no more than 5 to 10 times the standard.

Emissions vs. feedrate data for different facilities have previously been presented in work performed by EER for EPA in the late 1990s.[3,4] These data in general support the above conclusion for SVM.

LVM

Standards for LVM are not based on normal emissions. Feedrate limits for LVM are set at the feedrates demonstrated in performance tests with no extrapolation allowed. Nevertheless, it is of interest to examine the theoretical effect of LVM feedrate on SRE. For LVM, a similar analysis was conducted to that described above for SVM with the following results:

If an LVM has a vapor pressure at combustion temperature that is negligible compared to MTEC, then Region C of Figure 1 is dominant, SRE will not change significantly with feedrate and downward extrapolation should be valid. Table 1 shows that this is the case for chromium and beryllium.

The situation is less clear with arsenic. Arsenic forms a number of complex compounds with other metals (e.g., aluminum and silicon), which are always present in cement kilns and are typically present in the ash from other HWCs as well. Thus, the effective volatility of arsenic depends on the matrix of ash components. However, thermodynamic data are inadequate to fully take these "matrix" effects into account. If matrix effects are ignored (as was the case for calculations presented in Table 1) arsenic would appear to have a non-negligible vapor pressure at combustion temperature such that Regions B and C of Figure 1 would both be important and downward extrapolation would not be appropriate. However, arsenic has been classified as an LVM because measured SREs for arsenic are typically more in line with Cr and Be (hard-core LVMs) than with Pb and Cd (SVMs).[3] For this reason, we cannot use theoretical thermodynamic equilibrium calculations to assess the validity of downward extrapolation for arsenic

Wet Scrubbers

SVM

Control of SVM in wet scrubbers should follow the same logic as discussed above for dry APCDs.

Mercury Capture for HWCs with Chlorine in the Waste

The situation for mercury is a bit more complicated. Mercury is a volatile metal. It is more soluble in the chlorinated form ($HgCl_2$) than the elemental form (Hg). If chlorine is present in

[3] EER Corp., "Updated Guidance on Metals Interpolation and Extrapolation for Hazardous Waste Combustors", prepared for EPA OSW, September 1996.
[4] Springsteen, B.R.,Clark, W., and Rizeq, R.G.,"Use of Metals Extrapolation and Surrogates for Evaluating Metals Limits" Incineration Conference, 1997

the waste at any appreciable level, mercury in the combustion gas speciates to the more soluble $HgCl_2$. The situation that would lead to the least fraction of mercury speciating to the soluble form would be when the chlorine MTEC is at the lowest and the mercury MTEC is at the highest. The lowest chlorine MTEC for LFBs with wet scrubbers is 600,000 ug/dscm and the highest mercury MTEC is 10,000 ug/dscm. Figure 8 shows that, even at these extreme MTECs, equilibrium predicts that virtually all mercury is in the chloride form at temperatures below 550 C. Figure 9 shows that at 300 C, a temperature well above where wet scrubbers operate, at the highest mercury MTEC of 10,000 ug/dscm, virtually all mercury is in the chloride form at a Cl/Hg molar ratio above 3. The Cl/Hg ratio needed increases with decreasing mercury MTEC. Figure 9 shows that for an Hg MTEC of 30 ug/dscm (shown by the pink line), a Cl/Hg ratio above 25 is needed to ensure that virtually all mercury is in the chloride form.

For a soluble gas such as $HgCl_2$, the rate of absorption in a wet scrubber is proportional to the difference between the concentration in the bulk gas and the concentration at the gas/liquid interface, which is in equilibrium with the concentration in the liquid at the interface. There is a concentration gradient from the bulk concentration in the gas down to the gas concentration at the gas/liquid interface, which is in equilibrium with the liquid concentration at the gas/liquid interface; and there is a concentration gradient from the liquid concentration at the gas/liquid interface down to the bulk concentration in the liquid. The wet scrubber's efficiency is limited by the concentration of the mercury in the scrubber liquid. The equilibrium vapor concentration of $HgCl_2$ over a solution of scrubber liquid depends on the concentration, pH, and temperature of the liquid. Figure 10 shows that the equilibrium vapor concentration increases with pH and with scrubber liquid temperature. Figure 11 shows that the equilibrium vapor concentration increases with increasing liquid concentration. A decrease in liquid concentration results in a less-than-proportional decrease in equilibrium vapor concentration.

The impact of this effect (that equilibrium mercury vapor concentration decreases less than proportionally with a decrease in mercury liquid concentration) on downward extrapolation is as follows:

- If the mercury MTEC decreases and the scrubber liquid mercury concentration decreases proportionally (as would be the case under steady state conditions with constant blowdown of the scrubber liquid), then mercury SRE should increase slightly with decreasing MTEC, and downward extrapolation would be conservative.

- If the mercury MTEC decreases and the scrubber liquid mercury concentration does not decrease proportionally (as could be the case if blowdown is decreased or as could happen temporarily under transient conditions if the liquid concentration in the scrubber liquid has not yet adjusted to a change in mercury MTEC) then mercury SRE may decrease with decreasing MTEC and downward extrapolation would not be conservative.

Thus if chlorine is present in the waste at any appreciable level (i.e., at a Cl to Hg molar ratio above 50) it is appropriate to use downward extrapolation to establish mercury feedrate limits with the following caveats:

Figure 8. Equilibrium Hg Speciation as a Function of Temperature

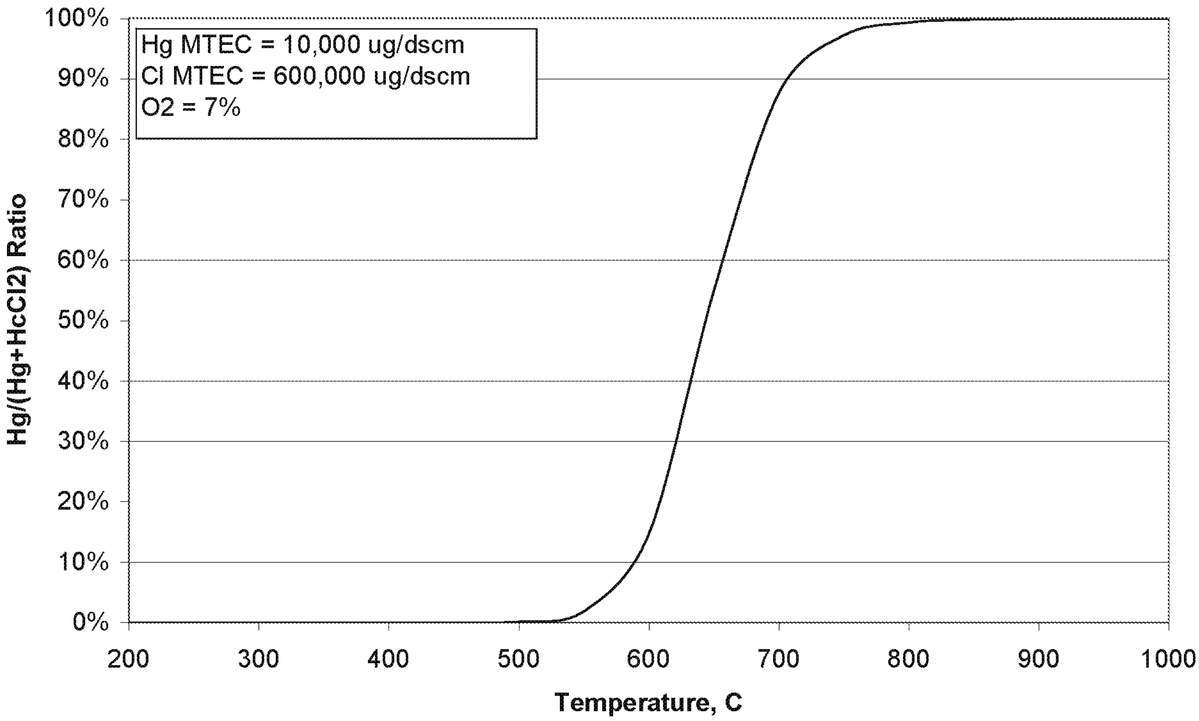


Figure 9. Equilibrium Hg Speciation as a Function of Cl/Hg Ratio

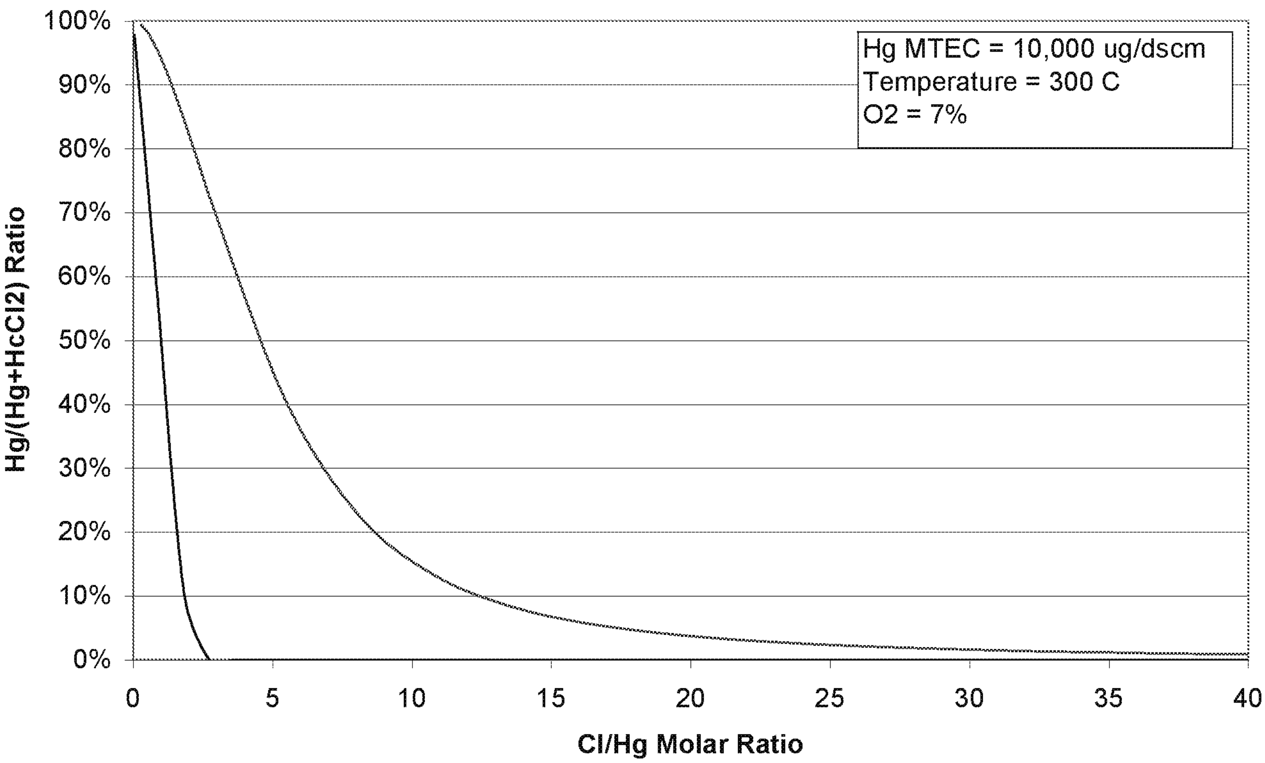


Figure 10. Effect of Temperature and pH on Vapor/ Liquid Equilibrium $HgCl_2$ Concentrations

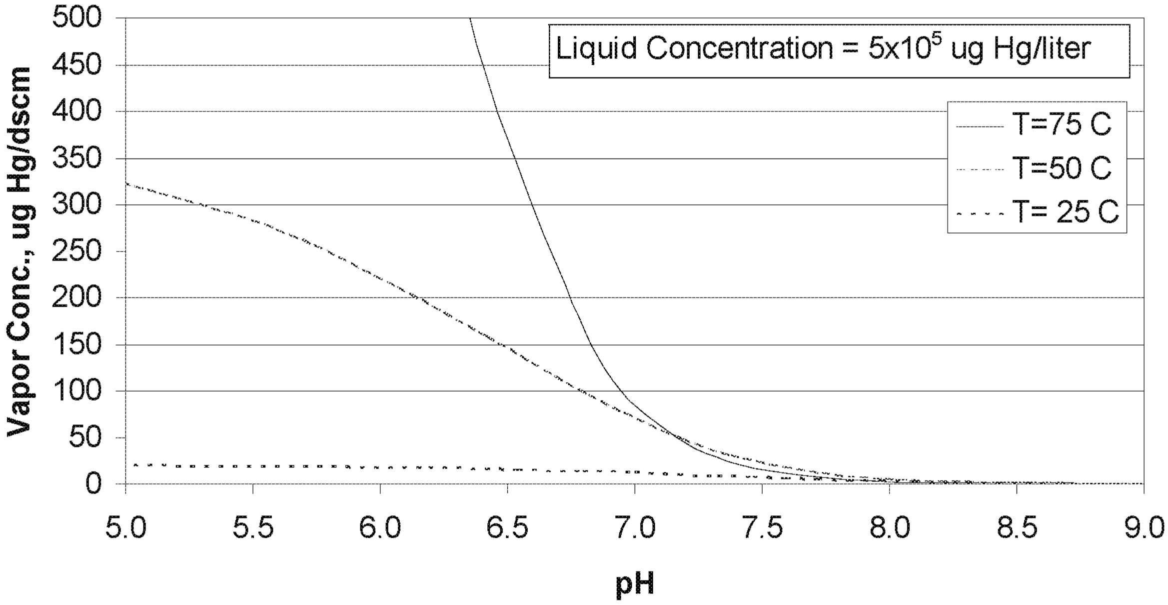
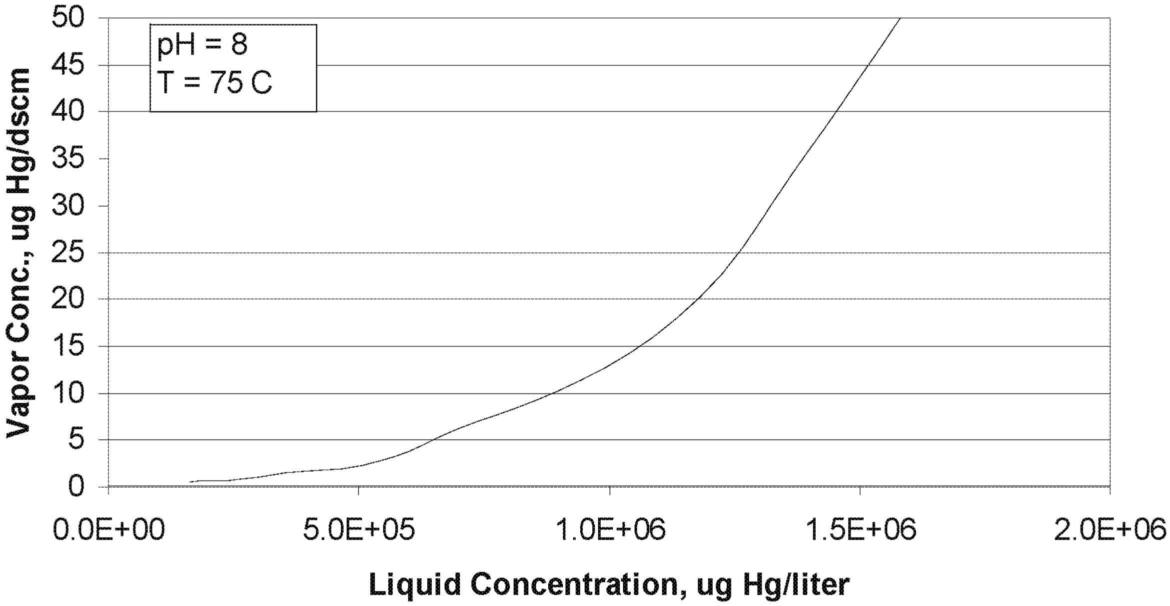


Figure 11. Effect of Concentration on Vapor/ Liquid $HgCl_2$ Equilibrium



- The performance test should be conducted under worst case conditions of minimum blowdown of the scrubber liquid; and test conditions (Hg feedrate) in the performance test must be maintained long enough for the scrubber system to come to steady state equilibrium with respect to mercury concentration. Note that this time can be shortened by spiking the scrubber system with the appropriate amount of mercury.

- The performance test should be conducted under worst case conditions of minimum pH in the scrubber liquid.

- The performance test should be conducted under worst case conditions of maximum temperature in the scrubber liquid.

Mercury Capture for HWCs without Chlorine in the Waste

Even if a source does not burn chlorinated wastes, there will be a small amount of ubiquitous chlorine, and what little mercury capture a wet scrubber achieves will still be due to the capture of mercury chloride. In the most likely scenario for downward extrapolation, if the mercury concentration is increased for the performance test, but the chlorine concentration is not increased proportionally, then a smaller fraction than normal of the mercury will be converted to soluble, capturable $HgCl_2$. Thus, the mercury SRE for the performance test will likely be lower than it would at lower mercury feedrates and downward extrapolation would be appropriate.

Appendix C: Information and Guidance on Particulate Matter Detection System Use and Correlation Testing

Contents

1.0 Background and Justification

The objectives of using Particulate Matter Detection Systems (PMDS) for Compliance Assurance include:

1. Ensuring compliance with PM (and SVM and LVM) standards either by:
   (a) Ensuring mass PM emissions do not exceed the level achieved during the performance test (i.e., ensuring the detector response does not exceed the average of the test run averages during the performance test); or
   (b) Conducting an approximate correlation of the detector response to PM concentrations, where the alarm level is either the detector response correlating to 50% of the PM standard or 125% of the highest PM concentration used to develop the correlation, whichever is greater. The extrapolated PM concentration must not exceed the particulate matter emission standard, however.
2. Alerting operators to degradation in performance of the PM control device indicating that the device is not operating consistent with good air pollution control practices for minimizing emissions;[1]

[1] See 63.6(e) *Operation and maintenance requirements.* (1)(i) At all times, including periods of startup, shutdown, and malfunction, the owner or operator must operate and maintain any affected source, including

3. Providing an incentive for HWCs to install and gain operational experience with detectors than can ultimately meet Performance Specification 11 (PS-11).

The final rule allows sources to use PMDS in lieu of a bag leak detection system (BLDS) for FFs, and as an alternative to site-specific operating parameter limits (OPLs) for ESPs and IWSs. Sources that elect to use a PMDS are required to take corrective measures if the detector response exceeds an alarm level. If a source operates above the alarm level more than 5% of the time in a 6-mo block period, the source must submit an exceedance report. The PMDS alarm level is established as either: (1) the average detector response during the comprehensive performance test when controllable operating parameters are maximized to simulate maximum variability; or (2) the detector response correlating to 50% of the PM standard or 125% of the highest PM concentration (but not exceeding the PM standard) used to develop an approximate correlation, whichever is greater.

Incentives to use PMDS include: (1) for ESPs and IWSs, an exceedance of the PMDS alarm level triggers the need for corrective measures while exceeding an OPL triggers an AWFCO (automatic waste feed cutoff); (2) a PM detector may be selected that can achieve PS-11 to facilitate ultimate compliance with §63.1209(a)(1)(iii) (which requires installation of a PM CEMS); and (3) a real-time measure of PM emissions can facilitate maximum combustor operations without exceeding PM and SVM/LVM standards.

PMDS are encouraged under the HWC MACT rule for two reasons. First, a PMDS provides substantially better compliance assurance than OPLs. Second, because PMDS provide a more reliable indication of changes in PM/metals emissions, they serve to enhance and expedite the capability of diagnosing and correcting emission control performance problems. This feature will not only reduce emissions, but it will also reduce staff time to diagnose and to remedy problems. Experience with BLDS show that they can pay for themselves within a year by reducing loss production time and staff time from early warning of a bag leak or failure. When a typical bag hole or tear (initially with just a small < 1 inch opening) is detected soon after occurrence (within 1-2 hours), there is a relatively small amount of dust (PM) to cleanup and remove from the compartment containing the damaged bag. However, when a damaged bag is not detected until 1-2 days after problem initiation, the damage increases exponentially in that adjacent bags also become damaged as a direct result of the original problem. This cascading effect of damaged bags not only increases the number of bags to be replaced, but also escalates substantially the amount of dust (PM) to cleanup and remove, requiring much more staff time and production downtime or production derating. Similarly, the diagnostic feature of PMDS is fully expected to have the same economic and environmental benefits on other types of emission control devices. This win-win benefit is why PMDS are prevalent and highly regarded in European countries. Their experience from the 1990s clearly shows that over time PMDS reduce the list of recurring, unpreventable problems and, as a consequence, improve emission control performance and reliability for well-operated and –maintained emission control devices.

---

associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions.

Many facilities employ procedures and technical staff able to operate and maintain their production and emission control equipment efficiently by following best practice guidelines and scheduling regular outages. Over time their technical staff has learned how to diagnose, minimize, and correct the normal set of operation-related and equipment-condition problems associated with their facility. As a result of this experience, the list gets shorter for the recurring, unpreventable problems requiring attention for well-operated and –maintained emission control devices.

2.0 Testing to Establish an Approximate Correlation

You may establish the alarm level as either:

1. The average detector response during the comprehensive performance test calculated as the average of the test run averages; or
2. If you conduct an approximate correlation of the detector response to PM concentrations, the detector response correlating to 50% of the PM standard or 125% of the highest PM concentration (but not exceeding the PM standard) used to develop the correlation, whichever is greater.

We discuss below test procedures and provide guidance on developing the approximate correlation.

2.1 Procedures for Conducting an Approximate Correlation

You may extrapolate the average of the test run averages of the detector response achieved during the comprehensive performance test to establish a particulate matter concentration alarm level after you approximate the correlation of the detector response to particulate matter concentration. You must comply with the extrapolated alarm set-point on a 6-hour rolling average, updated each hour with a one-hour block average that is the average of the detector responses over each 15-minute block.

To establish an initial approximate correlation of the detector response to particulate matter emission concentrations, you should use as guidance Performance Specification-11 for PM CEMS (40 CFR Part 60, Appendix B), except that you need only conduct 5 runs to establish the initial approximate correlation rather than 15 runs required by Section 8.6 of PS-11.

For quality assurance, you should use as guidance Procedure 2 of Appendix F to Part 60 and the detector manufacturer's recommended procedures for periodic quality assurance checks and tests, except that:

1. You must conduct annual Relative Response Audits as prescribed by Section 10.3 (6) of Procedure 2; and
2. You need only conduct Relative Response Audits on a 3-year interval after 2 sequential annual Relative Response Audits document that the correlation is within 20% of the reference method measurement at emission concentrations achieved during the comprehensive performance test.

An exceedance of the detector response that correlates approximately to the particulate matter emission standard is not evidence that the standard has been exceeded. The approximate correlation is used for compliance assurance to determine when corrective measures must be taken. The approximate correlation may not achieve the correlation coefficient, confidence interval half range, and tolerance interval half range required for PM CEMS under Section 13.2 of PS-11, and the PMDS is not required to comply with the rigorous quality assurance provisions of Procedure 2 in Appendix F of Part 60. Thus, the PMDS does not meet the requirements for compliance monitoring.

2.2 Rationale for Procedures for Extrapolation

2.2.1 Initial Correlation

PS 11 requires a minimum of 15 and a maximum of 20 runs for the initial correlation. Paired reference method trains are highly recommended but not required to identify and screen the reference method data for imprecision and bias. Procedures for checking reference method data for bias and precision can be found in the PM CEMS Knowledge Document (see section 16.5).[2]

Under PS-11, the range of the CEMS is up to 125% of the highest PM concentration used to develop the correlation. The range of the CEMS for low emitting sources (i.e., defined by Section 3.16 of PS-11 generally as sources that do not emit PM at concentrations that exceed 50% of the PM standard during the most recent performance test or on a daily average) is the greater of 50% of the PM standard or 125% of the highest PM concentration used to develop the correlation.

We considered these PS-11 requirements for compliance monitoring when establishing the procedures for PMDS for compliance assurance. We believe that only 5 runs rather than 15 may enable sources to establish an acceptable correlation for the purpose of compliance assurance, using the performance criteria in Section 13.2 of PS-11 as guidance rather than requirements. We considered requiring only 3 runs, but were concerned that sources would not be able to achieve a correlation with credible performance criteria (e.g., correlation coefficient, confidence interval, and tolerance interval). We also considered requiring 9-12 runs, but were concerned that the additional testing cost would not be warranted for purposes of compliance assurance and might discourage their (voluntary) use. We believe that use of a PMDS, even with an imperfect correlation to PM concentrations, is far superior to OPLs (or a BLDS for FFs where the alarm level is not related to emission concentrations) for compliance assurance, given that there is often only a gross relationship between OPLs and PM emissions. Consequently, we believe that requiring a minimum of 5 runs for the initial correlation is within the range of values we could have reasonably selected.

We also believe it is reasonable to adopt the CEMS range extrapolation provisions for PS-11 to establish alarm set-points for PMDS. Consequently, the rule allows sources that conduct an approximate correlation to establish the alarm set-point at the detector response that correlates to 50% of the PM standard or 125% of the highest PM concentration used to develop the

[2] USEPA, "Current Knowledge of Particulate Matter (PM) Continuous Emission Monitoring." EPA–454/R–00–039. September 2000.

approximate correlation, whichever is greater. The extrapolated emission concentration must not exceed the particulate matter emission standard, however. Note that, for purposes of a PMDS, a source need not meet the PS-11 definition of low-emitting source to extrapolate the detector response to 50% of the PM standard as the alarm set-point. Given that a source must take corrective measures when the alarm level is exceeded, only sources with normally low PM emissions would establish the alarm set-point at a detector response correlating to 50% of the PM standard.

Although paired trains are not required, we highly recommend them particularly given the low additional cost and that the rule requires only 5 runs for the initial correlation and only 3 runs for the Response Correlation Audit. It may be far less expensive to use paired trains initially than to determine that a credible correlation cannot be obtained with only 5 single train runs (or 3 single train runs for the RCA) and then to have to rerun the correlation testing. For example 5 single train runs would cost approximately $6,000 (not including the cost of determining the correlation) while 5 paired trains would cost only approximately $8,000.

2.2.2 Quality Assurance

For PM CEMS, Procedure 2 of Appendix F in Part 60 requires an Absolute Correlation Audit (ACA) each quarter where the CEMS is evaluated for its response to a series of reference standards covering the full measurement range of the instrument. In addition, Procedure 2 requires a Response Correlation Audit (RCA) at the frequency required by the individual regulation where the initial correlation testing is repeated, except that a minimum of 12 runs is required rather than 15 runs for the initial correlation. Procedure 2 also requires a Relative Response Audit (RRA) at the frequency required by the individual regulation where you collect three simultaneous reference method PM concentration measurements and PM CEMS measurements at the as-found source operating conditions and PM concentration.

We considered similar requirements for a PMDS, but conclude that requiring an annual RRA, combined with requiring compliance with the manufacturer's recommended procedures for periodic quality assurance checks and tests, would properly balance the need for quality assurance (for compliance assurance purposes) and the need to control costs to encourage sources to volunteer to use PMDS in lieu of OPLs (or a BLDS for FFs where the alarm level is not related to emission concentrations).

Finally, to avoid unnecessary testing and to minimize cost, the RRA is required on only a 3-year interval after passing 2 sequential annual RRAs

2.3 PM Detector Response Characteristics

Typical PM detectors are instruments designed to infer PM concentrations by measuring secondary properties of the suspended particles in an exhaust gas stream. Most instruments undergo a factory quality assurance check and calibration to ensure identical instrument response for all identical detectors under a given set of PM conditions. All PM detectors are designed with a linear instrument response with the secondary property they are measuring, such as light scattering or other light-related properties, charge transfer, or Beta-ray attenuation.

The instruments' response is also relative, but not necessarily linear, to actual in-stack PM concentrations for a given set of particle characteristics, such as composition, size distribution, density, charge, velocity, and index of refraction. Unfortunately, in many instances when there is a change in PM concentration, there is also a resultant change in one or more other particle characteristic(s), such as composition, size distribution, density, etc. Given a shift in particle character, there is usually a corresponding shift -- either subtle or significant -- in the relationship between PM concentrations and instrument response. The relationship between PM concentrations and instrument response is generally referred to as the correlation.

The extent to which the correlation will be linear and reproducible primarily depends on the site-specific factors affecting the production and the site-specific factors affecting the collection of the uncontrolled PM. The factors producing the uncontrolled PM include the nature and variety of the waste, fuel, and/or product-related feedstreams and combustor design. The factors affecting PM collection include the performance characteristics of the emission control device(s) and the nature of the factor changing control device performance. Examples of factors changing control device performance and emission level would include operation-related changes (such as energy input, material input, gas volume and temperature) or maintenance-related equipment-condition changes (broken/defective bags, plates, wires, rappers or partially/fully plugged hoppers, pipes, and demistors).

Given that PM detectors have not been required in most regulations, there is limited information and experience for EPA to share. Some investigators reported good empirical correlations between mass concentration and PM detector response, while others indicated that the effect of particle characteristics on the correlation was too strong for a meaningful correlation across a wide range of facility operations. The information currently available is discussed below.

There are at least five analytical principles used in PM detectors to measure or indicate changes in PM concentrations, including:

- Light scattering
- Beta attenuation
- Probe electrification
- Light extinction, and
- Optical scintillation.

Each of the above types of PM detectors is sensitive to changes in particle size and other particle characteristics such as composition, density, charge, velocity, and index of refraction. Of these types, there are emerging indications that Beta attenuation detectors are less sensitive to changes in particle size and other particle characteristics. The emerging indications consist of previous PM CEMS demonstrations at hazardous waste incinerators located in Delaware and Indiana and a coal-fired cogeneration boiler located in North Carolina. During each of the three demonstrations, Beta gauges exhibited a linear relationship between PM detector response and PM concentration. For the other types of PM detectors, indications are that they may or may not show a linear relationship between detector response and PM concentrations, with one exception. Data from the EPA sponsored coal-fired cogeneration boiler study indicated a linear response between light scattering monitors and PM concentrations downstream of a fabric filter. In the near future, PM CEMS correlation data from use on consent-decreed coal-fired electric utility boilers will be useful to see the general trends in the type and stability of correlation relationships for the available emission control technologies (FFs, ESPs, and wet scrubbers).

PS-11 requires that the user examine 5 different mathematical relationships and select the one producing the best fit. The five mathematical relationships are linear, logarithmic, polynomial, exponential, and power. PS-11 provides details on calculation of correlation coefficients and other statistical parameters required for PS-11 compliance and calculations for verifying the best fit.

2.4 Guidance for Correlation Testing

The main issues to resolve during the pre-test planning and correlation test periods are the following:

- Plant personnel must learn how to properly operate the PMDS and how to use the PMDS to diagnose control device performance problems and process upsets.

- The process should operate during normal conditions and over its full operating envelope, especially in the areas expected to affect PM concentration (e.g., all expected waste feeds, all fuels, start-up and shutdown, sootblowing, and normal emission control performance problems).

- The proper measuring range or sensitivity level must be set such that normal operations are approximately 6 to 10 mA output, but that concentrations at and above the emission limit do not exceed the upper measurement point (i.e., 20 mA for most PMDS with an operating range from 4-20 mA).

- The operating conditions that produce low and high PM concentrations should be documented so that those conditions can be reproduced for the correlation test. If changes in operation cannot produce a range of PM concentrations, some technique of simulating a normal emission control performance problem can be used.

During the correlation test, a critical task is to carefully and properly perform the manual Reference Method tests. This is critical because the accuracy of the PM detectors correlation can be no better than the accuracy of the Reference Method measurements used as the basis for the correlation. Another important point is to coordinate starting and stopping of the test runs with the sampling interval of the PM detectors, if port changes during the Reference Method tests take a long time (e.g., 5 minutes or more), the PM detector data during port changes can be discarded from the PM detector's average output. Obtaining concentration results in the field is highly recommended. This requires sample recovery and laboratory gravimetric analysis in the field. Furthermore, checking the progress of the test program by plotting the Reference Method values against the PM detector output during the correlation test is highly recommended because of cost-effective and quality assurance benefits.

At most sources, some effort (e.g., operational changes or adjustments to the emission control system) may be needed to obtain a suitable range of PM concentration levels. Testing at PM concentrations above the emission limit is not required and should be avoided. Some examples of how a source might obtain a range of PM concentrations are the following:

1. Process condition changes

For lower PM concentrations:

- Burn only natural gas;
- Stop or reduce product feed;
- Shut off process and only run the induced draft or forced draft fans;

For higher PM concentrations:

- Change fuels or use worst-case fuel;
- Increase ash content in feedstreams;
- Change or increase product or waste feed rate.

2. Emission control performance changes

• In general, simulate normal, unpreventable emission control performance problems, or bypass the emission pollution control system with a small slipstream of the main effluent stream. (Note that, bypassing or detuning an emission control system could cause PM stratification and could make it difficult to pass the PS-11 performance criteria you use as guidelines for the PMDS.) For all cases, it is understood that the operator should restore the normal conditions after testing is completed.

For higher PM concentrations with a fabric filter:

- Increase bag cleaning frequency for one or more compartments;
- Bypass the fabric filter with a small slipstream of the main effluent stream;
- Simulate bag hole or tear by temporarily removing one bag at the tubesheet, and either temporarily replacing the bag with a gate valve to gradually open during testing, or replacing with plate with holes of appropriate size and number.

For higher PM concentrations with an electrostatic precipitator:

- Reduce electrical power input on one or more transformer-rectifier sets;
- Increase plate rapping frequency for one or more fields.

The EPA recognizes that some sources cannot create a wide range of PM concentrations for the correlation test. A source is allowed to perform the correlation test over the normal range of PM concentrations. The PM detector is then limited to how far its response can be used for reporting PM emissions (*i.e.*, may extrapolate to 125 percent of the highest PM detector response during the correlation test). For example, if the PM detector responses ranged from 9 mA to 10 mA during the correlation testing and the correlation is found to be linear, then the corresponding correlation equation from this data could be used up to a PM detector response of 12.5 mA (10 mA x 125% = 12.5 mA). The 12.5 mA detector response would serve as the OPL alarm level. However, if the correlation were found to be non-linear, then the extrapolation would be made to 125 percent of the PM concentration, and not 125% of the instrument response. For example, if the highest PM concentration during the correlation test were 0.010 grains per dry standard cubic foot (gr/dscf), then the corresponding PM concentration from this data could be used up to a PM level of 0.0125 gr/dscf (0.010 gr/dscf x 125% = 0.0125 gr/dscf). The PM detector response corresponding to this 125% PM level would serve as the OPL alarm level.

2.5 Cost Estimate of Initial Correlation Testing

The estimated cost of the initial correlation testing is $5,000 - $10,000. The cost would depend on at least three primary factors, including the number of runs, the number of test days, and whether the company providing the testing service would also be involved in determining and reporting the correlation results. The following describes 2 contrasting scenarios.

1. In a best-case, simple, least-cost situation, five individual one-hour Method 5 or 5i runs (i.e., <u>not</u> test conditions comprised of 3 runs each) over a range of emission levels could be completed in one day and later reported. This scenario assumes a HWC facility engineer would coordinate and manage the testing. The engineer would record and average the PM detector data corresponding to the Method 5/5i run periods, and then determine and report the correlation results. The estimated cost of the correlation testing in this least-cost situation is less than $5,000.
2. In a more worst-case, complicated situation, five individual one-hour Method 5 or 5i runs (i.e., <u>not</u> test conditions comprised of 3 runs each) over a range of emission levels would be completed over two days. This scenario also assumes a testing company engineer would be responsible for recording and averaging the PM detector data, producing the Method 5/5i results, and then determining and reporting the correlation results. The estimated cost of this testing and correlation service is $10,000.

3.0 Available EPA References and Guidance on PM Detectors

Available information describing the principles of operation and current manufacturers can be found in the USEPA report "Current Knowledge of Particulate Matter (PM) Continuous Emission Monitoring," report number EPA-454/R-00-039, September 2000.

EPA is also developing a PS-11 guidance document for PM CEMS scheduled for release in late 2005 or 2006. While the guidance will be more sophisticated than needed for PM detectors, parts of the PM CEMS guidance will help serve PM detector users. The guidance document will include spreadsheets designed to facilitate developing correlation relationships. The document also will discuss how to determine and handle stratification within the ductwork and how to use the spreadsheets to calculate correlation relationships. PM CEMS guidance will be helpful until EPA develops guidance specifically for PM detectors.

4.0 Level of Detection for PM Detectors

There is substantial documentation supporting the fact that PMDS can achieve a detection limit below 1.0 milligram per actual cubic meter (mg/acm). EPA is aware of BLDS instruments certified to meet levels of 0.01 mg/acm and PMDS can readily achieve detection limits well below 1.0 mg/acm. The following documents and references provide such support.

4.1. Current Knowledge of Particulate Matter (PM) Continuous Emission Monitoring

U.S. Environmental Protection Agency, EPA-454/R-00-039, September 2000.
http://www.epa.gov/ttn/emc/cem/pmcemsknowfinalrep.pdf
There are several references that PMDS achieve a detection limit of 1.0 mg/acm. See pages 35, 48, 53, and 59 in the above report.

4.2. Fine PM CEMS Evaluation Study: Status of a Current Joint European Project

Wolfgang Jockel, TUV Rheinland Group, D-51101 Koeln / Germany
Wahab Mojtahedi, SINTROL OY, FIN-00390 Helsinki / Finland

Presented at CEM – 2004, 6th International Conference on Emission Monitoring, Milan Italy, June 9-11, 2004.
http://www.cem2004.it/art/7_3.pdf

There are several references and tables showing that PMDS achieve a detection limit of 1.0 mg/acm or less. See pages 3, 6, 7, and 8 in the above conference article.

4.3 Draft Particulate Matter CEMS Demonstration, Volume I: DuPont, Inc. Experimental Station On-Site Incinerator, Wilmington, DE

U.S. Environmental Protection Agency, December 1997
http://www.epa.gov/epaoswer/hazwaste/combust/cems/pmcemsrp.pdf.

There are several references that PMDS achieve a detection limit of 1.0 mg/acm. See pages 1-17, 3-20, 3-23, and 3-23 in the above report.

4.4 Fabric Filter Bag Leak Detection Guidance

U.S. Environmental Protection Agency, EPA-454/R-98-015, September 1997
http://www.epa.gov/ttn/emc/cem/tribo.pdf.

There is one reference that PMDS achieve a detection limit of 1.0 mg/acm or less. See page 6 in the above report.

4.5 Sigrist-Photometer AG

Sigrist-Photometer AG manufacturers the CTNR light-scattering PM CEMS with a detection limit of 0.01 mg/acm. The monitor is suitable for the new European Standard EN14181, a new rule regulating the requirements and specifications for emission measurements of power plants, waste incinerators and other emission sources in Europe. Sigrist, specialists in PM CEMS for wet stacks, has supplied more than 350 units worldwide. Main features include a highly sensitive scattered light detector allowing measurement down to 0.01mg/dscm or less and an extractive sampling system to overcome moisture interference by sample heating.

http://www.engineerlive.com/european-process-engineer/process-equipment-update/13197/new-standard-en-14181-for-emission-measurement.thtml

6. **Environmental Systems Corporation** manufacturers the P-5B PM CEMS light-scattering monitor that has passed EPA Performance Specification 11 for PM CEMS with a detection limit of 0.5 mg/acm.
http://www.envirosys.com/pdf/P-5B_Particulate_Monitor.pdf

5.0 PM Detector Cost Estimates

Table C-1 shows summarized costs for PM detectors that were compiled from information provided by vendors and others who have experience with the use of PM detectors.

Table C-1. PM Detector Cost Estimate Summary

Cost Estimates	LS Insitu	LS Extractive	Beta	BLDS	COMS
First Costs					
Planning	680	680	680	680	680
Select Equipment	6,441	6,441	6,441	6,441	6,441
Support Facilities	1,585	1,585	1,585	1,585	1,585
Purchase CEMS Hardware	14,700	93,000	101,400	3,150	58,800
Install and Check CEMS	8,092	8,092	8,092	2,754	8,092
Initial Correlation Test	11,822	11,822	11,822	11,822	11,822
QA/QC Plan	4,268	4,268	4,268	4,268	4,268
	47,588	125,888	134,288	30,700	91,688
Annual Costs					
Day-to-Day Activities	2,531	2,531	2,531	2,531	2,531
PM Monitor RRA	6,375	6,375	6,375	6,375	6,375
PMDS ACA/SVA	1,206	1,206	1,206	1,206	1,206
Recordkeeping and Reporting	4,946	4,946	4,946	4,946	4,946
Annual QA & O&M Review and Update	3,230	3,230	3,230	3,230	3,230
Capital Recovery	8,501	22,499	23,695	5,564	17,629
Total w/o capital recovery	18,288	18,288	18,288	18,288	18,288
Total with capital recovery	26,789	40,787	41,983	23,852	35,917

Summarized below is information on the equipment and costs related to installation of BLDS and PM detectors.

Bag Leak Detector. Installation cost estimate of $1,500 consisting of mounting one small (~2-inch) port, adding a 110-volt service to the monitor, and adding signal wires from the monitor to a control room or other location for remote readout. A platform is typically not required.

Beta gauge. Installation cost estimate of $50,000 consisting of installing one large (~6-inch) port, an air-conditioned $25,000 shed to house the monitor, a platform near the port large enough for the shed and port access, and a 110- volt service to monitor and signal wires from monitor to control room or other location for remote readout.

Extractive light-scattering monitor. Installation cost estimate of $50,000 consisting of installing two large (~6-inch) ports, an air-conditioned $25,000 shed to house the monitor and its blower, a platform near the port large enough for the shed and port access, and a 110- volt service to monitor and signal wires from monitor to control room or other location for remote readout.

In-situ light-scattering monitor. Installation cost estimate of $2,000 consisting of mounting one port and possibly a partial platform, adding a 110-volt service to monitor, and adding signal wires from monitor to control room or other location for remote readout. A full-size platform would not necessarily be required. Installing an opacity monitor is more involved than installing an *in-situ* light-scattering monitor, which requires only one port of a smaller diameter and less platform.

Opacity Monitor. Installation cost estimate of $4,000 consisting of mounting two large (~6-inch) ports directly-opposed across the stack, installing a platform between the 2 ports, and adding a 110-volt service to monitor and signal wires from monitor to control room or other location for remote readout.

Message

From: Valdez, Heather [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=eb323347294d44009a369c3576798bdf-Valdez, Heather]
Sent: 4/4/2017 9:21:04 PM
To: Davies, Lynne [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=169eb6cbdebb4caf85f76390b8ab2674-LDavie12]; Knittel, Janette [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a955f914e8d34cb19b6f63ac60707d32-Knittel, Janette]
Subject: My desorber w/afterburner applicability notes
Attachments: Thermal Treatment Applicability for Chem Waste lm.docx; final response to Oregon on ORU 2014.pdf

Here are my notes and the 2014 letter I found from Linda

Heather Valdez
RCRA Project Manager, Chemical Engineer
RCRA Corrective Actions, Permits and PCBs Unit
Office of Air and Waste
EPA Region 10
1200 6th Ave, Suite 900, AWT-150, Seattle, WA 98101
(206) 553-6220
valdez.heather@epa.gov
